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GUZHEV Dmitry Alekseevich

DEVELOPMENT OF DYNAMIC METHODS FOR ESTIMATING INITIAL INVESTMENTS IN THE FORM OF CAPITAL INVESTMENTS

Specialty 5.2.4 Finance

Abstract

of the dissertations for the degree of Candidate of Economic Sciences

PhD supervisor:

PhD, Associate Professor

Sidorkin Dmitry Vladimirovich

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Relevance of the research topic. When implementing investment projects in the form of capital investments in modern conditions, initial investments increase from the moment of making a management decision to start the project until the facility is put into operation after completion of construction. The problem of exceeding the actual value of initial investments spent on the construction of the facility over the initial budget of the project is typical not only for domestic conditions, but also for the global practice of implementing investment projects.

The generally accepted international and domestic methodological recommendations for calculating the main performance indicators, including dynamic indicators, do not provide for the adjustment of the calculations of the values of such indicators at various stages of the life cycle of an investment project, including due to the increase in initial investments as the investment project is implemented. As a rule, the calculation of investment performance indicators is performed in the pre-investment phase, at an early stage of the life cycle of an investment project, so the values of such indicators are not achievable when calculating the actual financial resources spent on the construction of the facility in the pre-investment and investment stages.

Thus, the relevance of the topic of this dissertation is due to the need to propose approaches that allow for a correct assessment of initial investments, as well as the development of dynamic methods used to justify the effectiveness of investments in the form of capital expenditures.

Research topic coverage. The financial aspects of the feasibility study of an investment project have been studied by Russian authors such as P. A. Zhuravlev, A. M. Marukyan, E. G. Ostapchuk, O. S. Tamer, S. V. Firtseva, and E. A. Shcherbakova, as well as by foreign authors such as D. Akah, K. Arga, M. H. Ahmadi, A. Sammo, B. S. Syafwandi, A. R. Hiwana, and others.

The excess of actual financial resources over those planned at various stages of the investment project life cycle and the issues of determining initial investments are considered in the publications of domestic authors: A.V. Babkin, E. A. Volkova, V. V. Glazkov, I. V. Karakozova, M. V. Mashchenko, L. V. Tashenova; foreign

authors: D. R. M. Barokka, R. Punam, S. M. Rambo, C. A. P. Soares, B. Flyvbjerg, S. Shubham and other researchers.

The application of various scenario analysis approaches in the implementation of an investment project has been studied in the publications of Russian researchers: K. V. Zhukovsky, V. S. Kanhva, A. S. Kindrashina, A. M. Margolin, R. M. Melnikov, and S. V. Pupentsova; and foreign researchers: F. Anderson, I. Bishindarits, H. Yin, D. M. Melikoglu, H. Parra-Dominguez, G. Hernandez, and others.

The issues of dynamic indicators of investment efficiency have been studied in publications by domestic and foreign authors.

Various aspects of the net present value of an investment project are covered in the domestic studies by V. N. Krasnoshchekov, O. V. Loseva, N. Yu. Sukhodolskaya, O. S. Tamer, and M. A. Fedotova; and in the foreign studies by K. A. Abdulla, K. Arjuran, M. Illes, K. Kannaprian, P. Zhao, and others.

Research on the internal rate of return is presented in the domestic publications by Yu. V. Medyanik, N. S. Samoilov, Z. S. Terentyeva, A. S. Titova, and M. M. Filatov; and in the foreign publications by S. J. Agbeye, A. S. John, D. L. Prol, S. A. Uthami, K. V. Steininger, and other authors.

Research on the investment return index and the discounted investment return index is presented in the articles by Russian researchers: A. M. Batkovsky, A. V. Kundina, I. V. Trifonov, D. R. Khairullina, and O. E. Khrustalev; and by foreign researchers: R. Villafafila-Robles, V. Wu, E. P. Lopez, F. Maguer, I. Munne-Kallado, T. K. Chu, and others.

Research on the discounted payback period of investments is presented in the domestic publications by E. A. Ageeva, V. V. Kudryavtseva, V. B. Lyukmanov, I. I. Marushchak, I. G. Mylnik, D. A. Ovsyannikova, and T. A. Spitsyna; and in the foreign publications by A. Ijaz, A. Ramasamy, S. Sadeghi, R. M. Singh, H. Tang, and other authors.

However, in the scientific publications of modern domestic and foreign researchers, the issues of a variable approach to assessing initial investments at

various stages of the investment project's life cycle, as well as the impact of such an approach on calculating the main dynamic indicators of investment efficiency, have not been sufficiently addressed, which determines the theoretical and practical significance of the study.

The aim of the research is to develop a set of methodological guidelines for assessing initial investments and the main dynamic indicators of investment efficiency.

The main dynamic indicators of investment efficiency in the study are based on current internationally recognized and domestic approaches: net present value (NPV), internal rate of return (IRR), profitability index (PI), discounted profitability index (DPI), and discounted payback period (DPP).

Achieving the set goal necessitated the formulation and solution of the **following tasks:**

-adapt international approaches to the variative assessment of initial investments to the domestic conditions of the implementation of an investment project;

-systematize the categorical and conceptual apparatus of investment activity in relation to the assessment of initial investments;

-develop a methodological approach to the variative assessment of initial investments at various stages of the life cycle of an investment project, test its application on the example of a number of implemented projects, and perform a comparative analysis with domestic regulatory approaches;

- develop methodological recommendations for determining the range of dynamic indicators of investment efficiency (NPV, IRR, PI, DPI, DPP), taking into account the variable assessment of initial investments, test their application on a number of implemented projects, and perform a comparative analysis with generally accepted regulatory approaches.

The object of research is dynamic methods for evaluating initial investments in the form of capital expenditures.

The subject of the study is financial and organizational-managerial relations, as well as methodological tools that ensure the development of dynamic methods for assessing initial investments in the form of capital investments during the implementation of investment projects.

The theoretical basis of the dissertation research includes fundamental provisions of the theory of investment, investment assessment, scientific and methodological publications, articles in domestic and foreign periodicals, materials from scientific conferences and discussions, as well as legislative and other regulatory acts that govern investment activities.

The methodological basis of the study consists in the application of general scientific methods of cognition, economic and statistical methods of information processing, methods of system, comparative, factor analysis with the construction of scenario models, based on modern scientific methods of cognition of economic processes. The work used the modeling method, graphic and comparative methods of information processing.

The study is based on existing international and foreign regulatory methods and approaches for determining the amount of initial investments, calculating dynamic indicators of investment efficiency, published data that disclose information about the plans and implementation of certain investment projects, and publications in specialized domestic and foreign scientific journals on the subject of the study.

Research area. The study was carried out in accordance with the following points of the scientific specialty passport 5.2.4 - Finance (Economic Sciences) of the Higher Attestation Commission under the Ministry of Science and Higher Education of the Russian Federation: 7. Valuation of financial assets. Management of a portfolio of financial assets. Investment decisions in the financial sector; 18. Project and venture financing.

The scientific novelty of the study lies in substantiating the application of a variable approach to the assessment of initial investments and developing methods for determining the main dynamic indicators of investment efficiency, taking into

account this approach at various stages of the life cycle in the pre-investment and investment stages of an investment project.

The scientific novelty is revealed in the most significant scientific results obtained personally by the author and presented for defense:

1. The international approach to the variable assessment of initial investments has been modified to adapt its use in domestic conditions for implementing an investment project.

The assessment of initial investments, in international practice, at various stages of the investment project's life cycle in the pre-investment and investment stages, involves the use of the ASTM E2516-11 methodology developed in 2019 by the International Association for Cost Engineering Development. ASTM E2516-11 (2019) identifies five classes of initial investment assessment to determine the need for financial resources based on the increasing degree of certainty in project decisions and the purpose of the assessment. The study substantiates the possibility of applying the approach to initial investment assessment implemented in ASTM E2516-11(2019) in the domestic practice of implementing investment projects in the form of capital investments, despite the significant differences in the financial and economic conditions of implementing investment projects in domestic realities.

The modification of the provisions of ASTM E2516-11(2019) to domestic conditions was carried out by analytical comparison of the accuracy classes of ASTM E2516-11(2019), taking into account the assessment methods (stochastic or deterministic models), with the stages of justifying initial investments, which are accepted in domestic practice of implementing investment projects.

In ASTM E2516-11(2019), the planned range of assessment accuracy is regulated in intervals with typical variations in the upper and lower levels, which intersect with each other, which is not common for domestic approaches. The study substantiates the reduction to specific values of the planned range of assessment accuracy, which allows for the unambiguous identification of the ranges of compliance and application in domestic conditions.

2. The categorical apparatus of the study has been formed, and new concepts have been introduced into scientific circulation: "expected range of initial investments", "maximum amount of initial investments", and "scenario coefficient of investment efficiency". The introduced new concepts expand the conceptual apparatus of investment activity in the form of capital investments and allow for the differentiation of the conditions for applying these concepts for research and use in scientific and practical activities.

3. A methodological approach to the variational assessment of initial investments has been proposed and empirically tested on the basis of a number of implemented projects. This approach allows for the formation of an executable implementation budget at the feasibility study stage of an investment project, without adjustments in the direction of increase, and for the correct assessment of initial investments at various stages of the investment project's life cycle.

The values of the scenario investment efficiency coefficient and, as a result, the maximum amount of initial investment are determined in three scenarios for implementing an investment project: optimistic, pessimistic, and baseline.

The essence of the proposed methodological approach to the variational assessment of initial investments is as follows: at the main stages of the life cycle of an investment project (in the basic, optimistic, and pessimistic scenarios of an investment project), the maximum amount of initial investments is determined. During the testing, a comparative analysis of the proposed methodological approach to the variational assessment of initial investments with the regulatory domestic methods for determining initial investments was performed using the example of a number of implemented investment projects. A comparative analysis revealed that the use of regulatory domestic methods does not ensure the formation of a deficit-free and executable budget that can be adjusted upwards not only at the feasibility study stage of an investment project, but also at subsequent stages of the life cycle in the pre-investment and investment stages. The application of a methodological approach to the variational assessment of initial investments using the maximum amount of initial investments (in the pessimistic scenario) allows for the formation

of a deficit-free and executable budget for the implementation of an investment project at each stage of the life cycle, including at the early stage of the feasibility study of an investment project, when a management decision is made to start the project. This is an advantage of the proposed methodological approach over the existing domestic methods for determining initial investments.

4. Methodological recommendations have been formulated and empirically tested on the basis of a number of implemented investment projects to determine the range of dynamic indicators of investment efficiency (NPV, IRR, PI, DPI, DPP), taking into account the application of the maximum amount of initial investments in the scenarios of an investment project implementation, which allow for the calculation of the values of indicators that can be achieved at the pre-investment stage and at the initial stage of the project's life cycle.

Unlike the well-known international and domestic methods, which do not allow for calculating the values of the range of dynamic indicators of investment efficiency that can be achieved after the facility is put into operation, based on actual financial resources, the use of the developed methodological recommendations, taking into account the variable assessment of the initial investment range of dynamic indicators of investment efficiency (NPV, IRR, PI, DPI, DPR), allows for calculating the values of the considered indicators that can be achieved at the end of the investment stage, starting from the feasibility study stage of the investment project, in a pessimistic scenario of implementation.

Methodological recommendations have been developed for determining the range of dynamic indicators of investment efficiency (NPV, IRR, PI, DPI, DPP), taking into account a variable approach to assessing initial investments in domestic conditions. It is proposed to calculate the range of dynamic indicators of investment efficiency at the corresponding stages of the life cycle in the scenarios of implementing an investment project (optimistic, pessimistic, and basic) using the maximum amount of initial investments. The proposed methodological recommendations were tested using a number of implemented investment projects, and a comparative analysis was performed with the generally accepted methods for

determining the range of dynamic indicators of investment efficiency, which revealed the following.

The use of international and domestic regulatory methods for calculating the range of dynamic investment performance indicators (NPV, IRR, PI, DPI, and DPR) does not allow for obtaining achievable values based on the actual financial resources of initial investments after the facility is put into operation.

The application of the developed methodological recommendations, taking into account a variable approach to assessing the initial investment range of dynamic indicators of investment efficiency: NPV, IRR, PI, DPI, and DPR, allows, starting from the feasibility study stage of an investment project, to calculate the values of the considered indicators that can be achieved at the stage of putting the facility into operation, which is an advantage of the proposed approach over the regulatory methods for determining dynamic indicators of investment efficiency.

The theoretical significance of the research results lies in the expansion of scientific knowledge in the field of theory and methods of assessing the effectiveness of investments in the form of capital investments, through the refinement of the categorical and conceptual framework of investment activities and the development of methods for determining dynamic indicators of investment efficiency, taking into account the variable assessment of initial investments. The research results expand the understanding of the possibility of applying a variable approach to the assessment of initial investments, and also form the basis for further research that allows for the refinement and detailing of the impact of the variable assessment of initial investments on the values of dynamic indicators of efficiency, taking into account various financial and economic factors of the implementation of an investment project.

The practical significance of the research results lies in the possibility for the investor, technical customer, and developer to use a variable assessment of initial investments in the pre-investment phase, at the early stages of the investment project's life cycle, to ensure that the investment project is correct and feasible without adjustments to increase the budget.

The practical significance of the research results also lies in the possibility of using the proposed methodological recommendations for determining the range of dynamic indicators of investment efficiency (NPV, IRR, PI, DPI, DPP) for investors and customers, which allow them to achieve the values of these indicators planned in the pre-investment phase and at the early stage of implementing an investment project.

In addition, the practical significance of the research results for a credit institution, when organizing project financing, lies in the possibility of applying methodological recommendations for determining the range of dynamic indicators of investment efficiency (NPV, IRR, PI, DPI, DPP) when preparing a financial and economic model and organizing project financing. Also, for a credit institution, the practical significance of the application of the research results lies in the possibility of applying a methodological approach to the variational assessment of initial investments for developing a project cash flow budget during the investment stage of implementation.

When organizing project financing, the practical significance for a credit institution when the financial control is carried out by the surveyor is as follows. With the operational control of the surveyor of the cash flow of capital investments, it is possible to calculate the forecast indicators using the proposed development of methodological recommendations for determining the range of dynamic performance indicators, for plan-actual analysis during the investment stage of the project, while maintaining periodic reporting.

The application of a variative approach to the assessment of initial investments and the development of methodological recommendations for determining the main dynamic indicators of investment efficiency will increase the reliability of the assessment of initial investments and the calculation of dynamic indicators of investment efficiency in the implementation of investment projects in modern domestic conditions, regardless of the sources of financing: state budgets of all levels, private investments, and public-private partnerships.

Research approbation. The main theoretical proposals and conclusions, as well as the results of their practical application and approbation, were presented at seventeen international and all-Russian scientific and practical conferences in 2022-2026 and published in the Russian Science Citation Index. The research findings are being applied in the implementation of investment projects in the form of capital investments in St. Petersburg and the Leningrad Region by various participants in the investment process: the investor and customer (the Lenstroytrust group of companies), and the general contractor (Lider LLC), which is confirmed by certificates of use of the results of the dissertation research. In addition, certain provisions of the study are used in the educational process of the St. Petersburg State University of Economics in the discipline "Modeling of Accounting and Analytical Systems in the Digital Economy" when conducting lectures and practical tasks with students (undergraduate students), which is also confirmed by a certificate of use of the results of the dissertation research.

Publications. The main findings of the study have been published in eleven author's scientific articles (6.91 authored pages), one co-authored scientific article (0.87 authored pages, 0.61 authored pages), and a total of 7.52 authored pages.

The articles were published in journals included in the List of Peer-Reviewed Scientific Publications determined by the Higher Attestation Commission under the Ministry of Science and Higher Education of the Russian Federation:

1. Guzhev D. A. (2022) Limit volume of investments at various stages of the investment project implementation in the form of capital investments // *Academic notes of the International Banking Institute.* v. 2 (40) p. 30-55. (In Russian).

2. Guzhev D. A. (2022) Expected accuracy range of the volume of investments in the form of capital investments // *Tomsk State University Journal of Economics.* (60). p. 170-184. DOI: 10.17223/19988648/60/10. (In Russian).

3. Guzhev D. A. (2022) Application of consolidated standards for estimating the volume of investments at the stage of feasibility study of investments in the form of capital investments // *Financial economics.* (6). p. 19-22. (In Russian).

4. Guzhev D. A. (2022) Domestic and foreign standards for the feasibility study of an investment project investments in the form of capital investments // *Journal of economics, entrepreneurship and law.* 12. (8). p. 2261-2278. DOI: 10.18334/epp.12.8.115214. (In Russian).

5. Guzhev D. A. (2022) Assessment of the impact of the cash flow of capital investments on the internal rate of return of the investment project // *Vestnik of Samara State University of Economics*. No 9(215), p. 71-78. DOI: 10.46554/1993-0453-2022-9-215-71-78. (In Russian).

6. Guzhev D. A. (2022) Methodology For Calculating The Net Present Value Of An Investment Project, Taking Into Account The Variability of Determining The Cash Flow Of Capital Investments // *Finance and Credit*. vol. 28. No 9. p. 2016-2013. DOI: 10.24891/fc.28.9.2016. (In Russian).

7. Guzhev D. A. (2022) The effect of variability in determining the volume of initial investments on the profitability index // *Financial economics.* (12). p. 35-38. (In Russian).

8. Guzhev D. A. (2023) Sensitivity analysis of the Net Present Value, with a variable approach to the definition of initial investments on the stages of the investment projects // *Economic security*. (6). No 1. DOI: 10.18334/ecses.6.1.117392. (In Russian).

9. Guzhev D. A. (2023) Discounted payback period and variant approach to determining the initial investments in investment project scenarios. *Journal of Economics, Entrepreneurship and Law*. 13(6). p. 1911-1926. DOI: 10.18334/epp.13.6.117814 (In Russian).

10. Guzhev D. A. (2023) Analyzing the Sensitivity of Internal Rate of Return to the Variable Determination of Initial Investments in the Life Cycle to Calculate the Net Present Value of an Investment Project // *Finance and Credit*. vol. 29. No 9. p. 1496-1513. DOI: 10.24891/fc.29.7.1496. (In Russian).

11. Guzhev D. A., Sintsova E. A. (2023). Variable value of the discount rate and net discounted income with variable definition of initial investments in the pessimistic scenario of the investment project // *Journal of Economics,*

Entrepreneurship and Law. 13(10). p. 4443-4460. DOI: 10.18334/epp.13.10.119256. (In Russian).

12. Guzhev D. A. (2026). Calculation of the Discounted Profitability Index of an Investment Project, Taking into Account the Variable Assessment of Initial Investments and the Variable Discounted Rate // *Theory and Practice of Social Development.* (2). p. 137-142. DOI: 10.24158/tipor.2026.2.16. (In Russian).

Other publications

1. Guzhev D. A. (2023) Calculation of the discounted profitability index in investment project lifecycle scenarios, taking into account the variability of the cash flow of capital investments // *Chapter 5 in the monograph "Actual issues of modern science and education".* Penza, 2023 ISTC. – p 55-64. (In Russian).

The structure of the study is determined by its purpose and objectives, and consists of an introduction, three chapters, a conclusion, a list of references, and appendices. The study is presented on 222 pages and includes 66 tables, 179 bibliographic sources (including 63 foreign sources), and 7 appendices.