# Algorithms of financial stability control and internal rate of the investment project profitability

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**Abstract.** The paper presents algorithms of the financial stability control and its internal rate of the investment project return, which is designed to present the current control of the main parameters of the investment project in the managerial activities. An analysis of fair market value of corporation investment is offered. It was noted that the innovative project is determined, above all, by sufficient investment resources for the successful completion of the project, and the relation between the capacity of investment flows, the relevant budget innovative project. It was assumed that long-term financial stability is determined by the ability to parry the parent company of systematic deviations from the budget of the innovative project upward, arising from higher inflation, rising energy prices. This control algorithm informs about the current trends of change of the investment capital supply and demand parameters, the internal self-sufficiency capacity of corporations and the possibilities of successful completion of the innovation project.
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**Keywords:** adaptation, algorithm, external conditions, the bank, calculation, structure, potential, assessment, market, process, information, accounts payable, signal, receivables, liabilities, design, manufacture, corporation, enterprise, structure, control, result, resources, economic performance, debt capital, diversification, sources, innovation, investment, factor, financial stability, profitability, the break-even point, the risks, capitalization of the company, market value, the software product, software, management activities

## Introduction

The algorithm is designed to monitor the main parameters of the investment project in the process of management. Each administrative action of investment flow control system (IFCS), leading to changes in the characteristics of investment flows, requires the use of a control algorithm for the purpose of checking the short-term and long-term financial sustainability of the investment company, as well as the internal rate of return of the investment project.

## The main part

Fig. 1 is a block diagram of the first stage of the control algorithm designed to test short-term financial stability of the parent company, on the basis of calculating the parameters of the loan lever Short credit lever (Scl) in short-term loans and investment and credit relationships with banks. The calculation is based on the determination of the ratio of revenue for the reporting period and the total amount of short-term loans. If the value (Scl) is in the range [0; 1], then (d <r) and it is about investment and credit relationships. In this case, point in time ($n_a$) is calculated by the formula 1, after which the company is able to pay off the debt. If the term ($n_a$) is agreed with the credit institution, then the head enterprise does not lose financial stability in the period ($n<n_a$) (Rel - the ratio of equity to loans).

$$n = \frac{\ln(\mathrm{Rel})}{\ln[(1+d)/(1+r)]} \qquad (1)$$

If the value (Scl) lies in the range [1; 1.5] then (d> r) and as the result of the calculation start time ($n_b$) of the loss of financial stability of the enterprise is determined by the formula 1. These calculations are displayed in Table 1, where the real value ($n_b$) for different rates of return and the value of the loan are placed in the zone (O; A; O*; B*) and form a time interval [1.75; 4.39] years. If agreed with the bank credit terms of return (n) fall within the range ($n <n_b$), the entity does not lose financial stability. Otherwise, when ($n < n_a$) or ($n>n_b$) there is a need to work with receivables that changes leveraged a total capitalization of the enterprise. Working with

accounts payable reduces the period of the loan ($n_b$) and, accordingly, to the fall of its value.

**Table 1.**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Rel= | 1,25 | A | | | | O* |
| | Y | 15 | 25,77 | 12,94 | 8,66 | 6,53 | 5,24 | 4,39 | 3,78 | 3,32 | 2,96 | 2,68 |
| | I | 14 | 12,83 | 8,59 | 6,47 | 5,20 | 4,35 | 3,74 | 3,29 | 2,94 | 2,65 | 2,42 |
| | E | 13 | 8,52 | 6,41 | 5,15 | 4,31 | 3,71 | 3,26 | 2,91 | 2,63 | 2,40 | 2,21 |
| | L | 12 | 6,36 | 5,11 | 4,28 | 3,68 | 3,23 | 2,89 | 2,61 | 2,38 | 2,19 | 2,03 |
| | D | 11 | 5,06 | 4,24 | 3,65 | 3,21 | 2,86 | 2,59 | 2,36 | 2,17 | 2,01 | 1,88 |
| B | | 10 | 4,20 | 3,62 | 3,18 | 2,84 | 2,56 | 2,34 | 2,16 | 2,00 | 1,86 | 1,75 | B* |
| | | 9 | 3,59 | 3,15 | 2,81 | 2,54 | 2,32 | O 2,14 | 1,98 | 1,85 | 1,73 | 1,63 | |
| | | 8 | 3,12 | 2,79 | 2,52 | 2,30 | 2,12 | 1,96 | 1,83 | 1,72 | 1,62 | 1,53 | |
| | | 7 | 2,76 | 2,50 | 2,28 | 2,10 | 1,95 | 1,81 | 1,70 | 1,60 | 1,51 | 1,44 | |
| | | 6 | 2,48 | 2,26 | 2,08 | 1,93 | 1,80 | 1,69 | 1,59 | 1,50 | 1,42 | 1,35 | |
| | | 5 | 2,24 | 2,06 | 1,91 | 1,78 | 1,67 | 1,57 | 1,49 | 1,41 | 1,34 | 1,28 | |
| | % | 4 | 2,04 | 1,89 | 1,77 | 1,66 | 1,56 | 1,47 | 1,40 | 1,33 | 1,27 | 1,21 | |
| | | 3 | 1,88 | 1,75 | 1,64 | 1,55 | 1,46 | 1,39 | 1,32 | 1,26 | 1,20 | 1,15 | |
| | r | 2 | 1,73 | 1,63 | 1,53 | 1,45 | 1,37 | 1,31 | 1,25 | 1,19 | 1,14 | 1,10 | |
| | | 1 | 1,61 | 1,52 | 1,43 | 1,36 | 1,29 | 1,24 | 1,18 | 1,13 | 1,09 | 1,05 | |
| | | | | | | | Growth rate of the loan% d | | | | | |
| | | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | |
| | | | | | | | A* | | | | | |

If this action does not lead to a positive result, there is a need to restructure loans towards replacing longer in a few short. Lending operations with a positive evaluation of the characteristics of future internal and external conditions might be possible. The receipt of the positive results is followed by a return to the conversion value of leverage and terms of use and return on invested funds. In the case of systematic negative results in several iterations for working with accounts receivable and payable and restructuring of credit lines in the node (X) a signal is generated for IFCS warning about the loss of short-term financial stability of the investment company.

Such a situation indicates that the parent company has been functioning in a time of increasing the investment potential for sufficiently long period of time and has accumulated a large amount of debt, con contractual and fiscal obligations and requires transferring to normal operation for the next quarter or half a year [1]. In case of positive values ($n_a$) and ($n_b$) in the node (Y) a decision on continuation of the control algorithm of major economic indicators and the parent company of the investment project is formed. Next, there is a calculation of fair market value (FMV) of the parent company to compare values obtained with the previous calculated in the early management cycles IFCS (ΔS) Fig. 2. Calculation (ΔS) is made on the basis of the model [2]. If the value of FMV decreases, the investment potential of the parent company falls. This signal (1) immediately signal arrives in IFCS. As a stabilization measures there should be a reduction of the investment of the parent company. Reduction is made in a strictly defined sequence within secondary circuit of IFCS. First reduction of risk of the investment flow is made, which leads to Royalty fund capitalization growth stoppage [3].

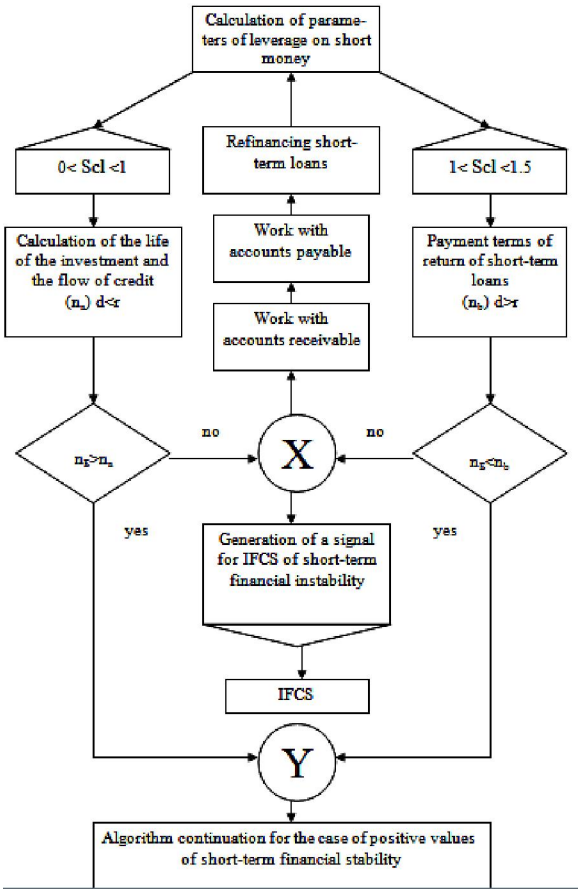



**Fig. 1. Algorithm of control of the short-term financial stability of the parent company**

Peak investment flow is disconnected from the replenishment of the parent company in the second turn, which leads to the suspension of stock resources capitalization growth. This step leads to an increase in the proportion of direct investment funds costly operations in comparison with collateral ones. Last direct investment flow undergoes reduction as the main stream of its own investment resources flowing directly into an innovative project. Further goes the analysis of fair market value (1/S) of corporation investment company [4]. Structure of the FMV company must comply relations of current and terminal values. Compliance with these conditions guarantees the investment potential when changing the phase of the life cycle of the parent company. In case of unsatisfactory values (1/S) it is necessary to make efforts to stabilize the FMV connection (2) for IFCS Fig.2. Restructuring of FMV enterprise occurs when changing phases of the life cycle of the company. Therefore, in the case of persistent negative values (1/S) efforts should be made in the direction of extension of the current stage of the life cycle. It is necessary to take into account that the stage of production adaptation presupposes the

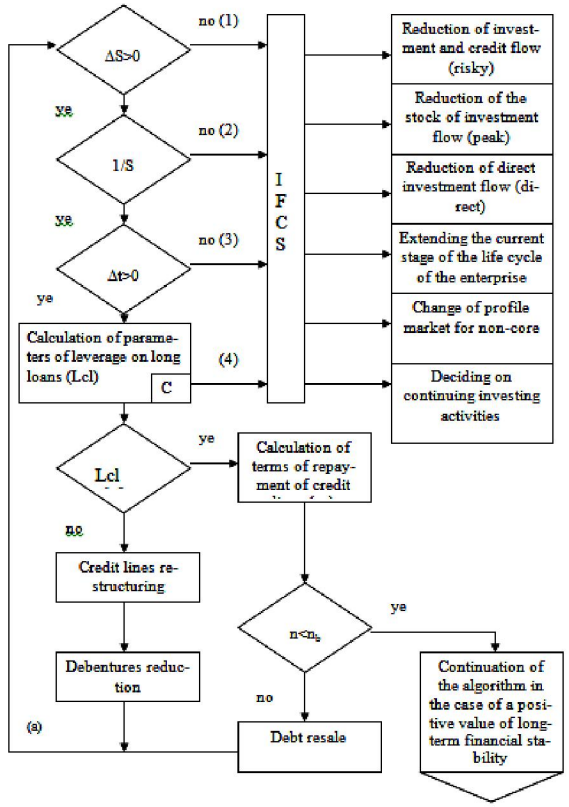
process of diversification of production and, as a consequence, its capital intensity and short-termism. If the expected duration of this phase exceeds the deadlines of innovative project, the task of diversification can be considered fulfilled and (1/S) will take the required values [5].

In the case of a negative reaction (1/S) on all measures, it is necessary to calculate the timing of the end of the investment activities of the enterprise. This calculation is to determine the period of occurrence of a zero profit or breakeven parent company balance [6] on the basis of statistical data of the current condition of the company and forecast calculations [7]. If the received timeslot (Δt) overlaps the timing of the completion of the innovative project, a decision on the continuation of investment in innovative production is taken, the relationship (3) for IFCS Fig. 2. Otherwise innovation project should be closed, restructured or significantly changed as to its basic parameters to reduce the resource burden.

A control unit of long-term financial stability of the investment company follows further. Calculation of parameters of leverage, long credit lever (Lcl), in long-term loans is based on the analysis of correlation of values of equity and borrowed capital, the optimal ratio is equal to (1.5) or (Lcl > 1.5). In case if the inequality is not satisfied, then a priori enterprise is in the danger zone of loss of financial stability. In this case the work should be done towards a greater share of equity or towards reducing liabilities. Further, when (Lcl>1.5) terms of repayment are calculated by the formula 1, where the value ($n_b$) of the moment of the loss of financial stability is determined, Table 2. Here the risk of losing financial stability is in the range from 0 to years in the area (O, A, D *, B *). This time interval is consistent with the terms of performance of high-tech innovation projects. If ($n>n_b$), and the restructuring of credit lines and debt reduction did not lead to positive results , it may be possible trying to resell the debt to interested third parties , possibly under the equity participation in the future earnings of the innovation project. If the inequality ($n < n_b$) is satisfied, then the long-term financial stability is considered to be satisfactory and control algorithm of the main economic indicators of the parent company and the innovative project gets its continuation.

If feedback (a) passes through several cycles without a positive result, in the node (C) a signal is generated for IFCS, communication (4), of curtailing the parent company investing activities or of the transition IFCS to crash-management mode, which involves the re-structuring or sale of the parent company.

**Table 2.**



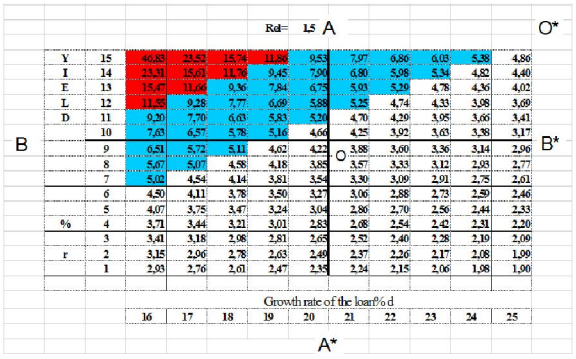




**Fig. 2. Control algorithm for long-term financial stability of the parent company**

This is followed by a block to calculate the internal rate of return of investment projects (IRR) by discounted cash flow method, Fig. 3. If the value (IRR) has fallen below the required value, then a signal for IFCS is generated that current administrative action is inefficient and reduces the profitability of the investment project. In this situation, IFCS management activities is to obtain additional investment income. These may be additional revenues from increased capitalization of unspent resources, raising the investment potential of the parent company and as a result of restructuring activities for the various structures of industrial

corporations. Then there is recalculation of the internal rate (IRR) of the investment project return. In case of satisfactory values (IRR) there should be a block of expert evaluation of innovative project deadline. We are talking about its final stage - weeks, months.

Here completion date may be determined by an expert. In case of delay detection when (Δt<0), it is necessary to temporarily raise additional resources, and in case of failure of "last-minute" decision, it is necessary to negotiate a postponement of the closure of the innovation project. The main role is played by risky investment flow as the main neutralizer of nonsystematic deviations from the estimates of the innovation project. If the results of the talks are positive, the project is further developed and ends at the moment (Δt=0). When working with the management and control algorithms [8] of the main parameters of the investment project, different types of investment flows depending on their purpose, Table 3, are involved in the investment process. When investigating alternative investment objects, primary focus is on the demand markets and investment capital proposition. Market demand [psi] offers production and financial projects of varying return, and in their realization all types of investment flows (+) are used, column 1. If there is a supply market (Δ) IC (investment capital) [9], its financial resources can replenish the deficit of direct, peak, risk and reserve investment flows, column (2).

Status of the innovative project is determined primarily by adequacy of investment resources for the successful completion of the project, and the relation between the capacities of investment flows, which are relevant to the budget of innovative project. The total volume of investment funds (V) is the sum of volumes of all investment flows (+), column 3. The ratio of investment funds is determined by comparing the amounts of all four investment flows, column 4. In forming their own investment potential of corporation direct, peak and risky investment flows are involved, which are based on the corporation funds. The reserve investment flow is focused on the investment potential of this innovative project which can carry out refund to creditors within the required time without disturbing the parent company financial stability. Then while forming the corporation capitalization (S) and investment potential of the parent company (1/S) the first three investment flows are involved, columns 5 and 6. Availability of debt capital in prospect weakens investment potential of the investment entity. The ratio of investment funds is determined by comparing the amounts of all four investment flows, column 4.

In forming their own investment potential of corporation direct, peak and risky investment flows are involved, which are based on the corporation funds. The reserve investment flow is focused on the investment potential of this innovative project which can carry out refund to creditors within the required time without disturbing the parent company financial stability. Then while forming the corporation capitalization (S) and investment potential of the parent company (1/S) the first three investment flows are involved, columns 5 and 6. Availability of debt capital in prospect weakens investment potential of the investment entity. Work to ensure the short-term financial stability of the organization is associated with the interaction with external credit institutions. Short-term loans are the replenishment of the parent company's current assets in the implementation of its current economic and investment activities. These tasks fall on the risk and reserve investment flows as they are designed to eliminate unsystematic and systematic deviations of the environment that are able to take the leading enterprise off the steady state, columns 7 and 8. Long-term financial stability depends on the ability of the parent company to parry systematic deviations from the budget of innovation project upward, arising from higher inflation, rising energy prices.

Such fluctuations can be forecast, analyzed and calculated and on their base long-term credit lines are formed that make up the basis of reserve investment flow, columns 9 and 10. Thus, different strategies and structures of investment processes require the use of different types of investment flows in industrial corporation and their diversification simplifies management processes significantly by providing them with multiple channels and independence. As it can be seen from Fig. 4, which shows the information control algorithm of internal rate of return of the investment project, the scheme includes conditions relating to aspects of market demand and supply of investment capital, adequacy ratio and total investment resources and innovative project parameters and is informative for IFCS and as a result, for the top management of industrial corporations.

The model of calculation of internal rate of return is followed by investment capital demand market analysis [10]. The first group of conditions characterizes the current state of the capital market. [Psi]-factor is defined as the difference between the value of the internal rate of return of the investment project (IRR) and the rates of return on alternative investment trends , such as the availability of various financial instruments . The negative value of [psi]-factor suggests that investing in financial instruments

is more attractive than in the real economy, a positive value of [psi]-factor testifies to the contrary.

[Psi] = IRR - d, where d is the rate of return of the financial instrument.

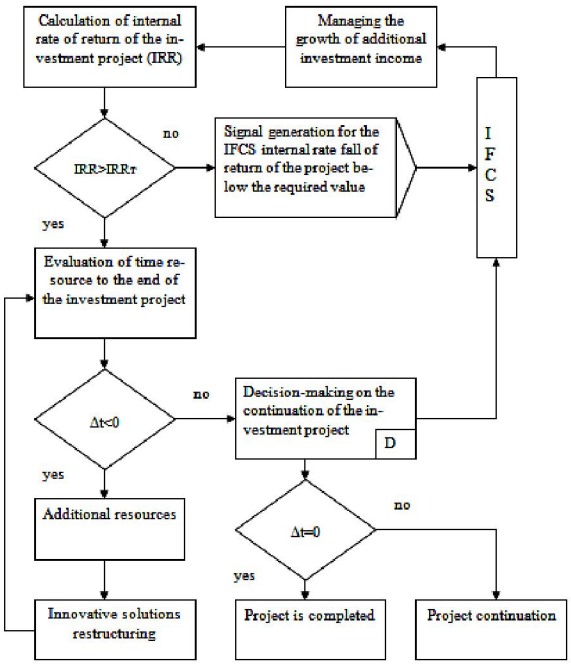



**Fig. 3. Control algorithm of internal rate of the investment project return and the terms of its actual completion.**

**Table 3. Management of investment flows over the cycle of creating innovative capacity**

| N/N | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| name | [psi] | Δ | V | 1/V | S | 1/S | Scl | $n_S$ | Lcl | $n_L$ |
| landmark | Demand market IC | Supply market IC | The volume of investment funds | The ratio of investment funds | The magnitude of corporation capitalization | Structure of fair market value of the enterprise | Short-term financial stability | Ability to repay the loan | Long-term financial stability | Ability to service the credit line |
| Management of investment flows in the fourth stage IR turnover at a macro level | | | | | | | | | | |
| direct | + | + | + | + | + | + | - | - | - | - |
| peak | + | + | + | + | + | + | - | - | - | - |
| risk | + | + | + | + | + | + | + | + | - | - |
| reserve | + | + | + | + | - | - | + | + | + | + |
| N / N | I | | II | | III | | IV | | V | |
| stage | IC market | | Innovation project | | Investment fund | | Short-term financial stability | | Long-term financial stability | |
| substance | Alternative investments | | Innovation condition | | Investment potential | | Ability to return funds | | | |

[Psi]-factor characterizes the state of demand on the investment capital.

Here market offers financial and industrial investment projects actively. If the yield of the proposed projects is higher than the current one, [psi]< 0 and a signal for IFCS is generated on the existence of more attractive area for investment on the mar ket.

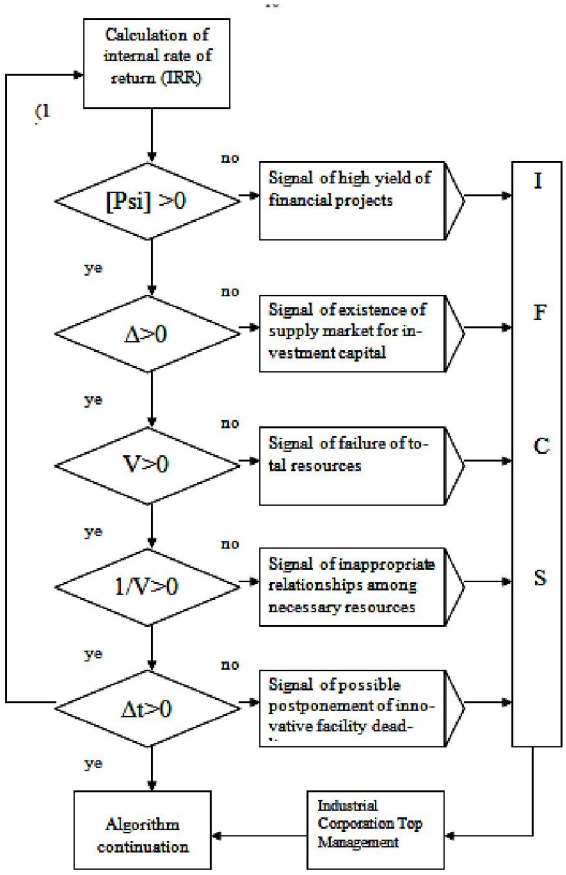



**Fig. 4. Informational control algorithm for calculating the internal rate of return of the investment project.**

At the initial stages of investment activity, such information may lead to a change of the innovation project. Δ–factor characterizes the state of the investment capital supply market, its cost and expenses to attract [11]. Δ = IRR - WACC, where WACC is weighted average cost of attracting investment capital.

In case of a negative Δ-factor attracting investment capital is meaningless, since the internal rate of profitability of the innovative project is lower than the cost of investment capital. In this case, there is a need to search for options to improve the IRR investment project or waive it. Factor Δ informs of the investment capital supply market availability. If the cost of external to the corporation of capital is less than the cost of their own capital, then (Δ<0) and it is possible to attract it in the current innovative project that will significantly reduce the accumulation phase of investment capital.

Condition (ΔV>0) indicates the adequacy of the total number of investment resources for the completion of the current innovation project. These

financial resources in the form of the financial equivalent are defined in function calculation block IRR function by discounted cash flow method. The fourth factor 1/V characterizes the current state of dynamic investment flows ratio. The last condition ($\Delta T=t_T-t_4$) is calculated as the difference between the start and end points of the current innovation project. If the value of IRR is less than the required magnitude, the correction of point in time (t4) is made upwards. Thus, by means of feedback (1) iterations are made until the desired value of internal rate of return for the time (t4) or corrected time for project completion (Ctpc) is reached. Then delay time for innovation project is defined as the difference: $\Delta t= Ctpc-t_4$. Here ($\Delta t$) means the price conservation IRR at the required level. If in the process of investment project ($\Delta t$) is increasing, the management of the corporation is forced to make a decision on the restructuring of the innovation project. If ($\Delta t$) is stable, then one of the possible solutions can be agreement to postpone delivery of the innovative project. If in the process of project ($\Delta t$) decreases, the drop IRR is less than the required value does not require any control actions by IFCS and top management of industrial corporations.

**Conclusions**

Given control algorithm is notifying and does not require making immediate management decisions and informs about current change trends of the supply and demand parameters of investment capital, the internal self-sufficiency capacity of corporations and the possibilities of successful completion of the innovation project.

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