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DOI: https://doi.org/10.30525/978-9934-26-717-8-8

THE IMPACT OF THE COST OF CAPITAL ON THE MINIMUM FINANCIAL RETURN OF A TRANSPORT INFRASTRUCTURE PROJECT

The recovery and low-carbon modernisation of Ukraine's transport infrastructure require substantial long-term investment. Given the high capital intensity and delayed financial returns of such projects, their feasibility depends not only on the initial investment costs but also on the cost of the funds raised and the timing of future revenues or savings.

Long-term loans, grace periods, grants, guarantees, and risk-sharing instruments provided by international financial institutions can reduce the financial burden on a project. The activities of the European Investment Bank and the European Bank for Reconstruction and Development in Ukraine demonstrate the use of blended financing packages [1–3]. At the same time, the involvement of an international institution does not predetermine a specific cost of capital, which depends on the financing structure and currency, maturity, interest rate, guarantees, and the project's risk profile.

The purpose of this study is to determine how the cost of capital and the appraisal period affect the minimum annual net financial return required to recover the initial investment in a transport infrastructure project. This approach makes it possible to assess the required financial return without relying on unjustified forecasts of revenues from specific projects, whose complete financial models are generally not publicly available.

For the purposes of the calculations, the initial investment is normalised to 100 notional units. The project is assumed to generate an equal net financial return at the end of each year, while its residual value at the end of the appraisal period is not taken into account. The net financial return may comprise revenues from transport services, reductions in operating and energy costs, infrastructure availability payments, budgetary compensation for socially important transport services, or a combination of these sources.

The present value annuity factor is used to discount equal annual financial returns to their present value. It is equal to the sum of the discount factors for all years of the appraisal period and represents the present value of a stream consisting of one monetary unit received at the end of each year:

$$K = \frac{1 - (1 + r)^{-n}}{r},$$

where K is the present value annuity factor for equal annual inflows; r is the cost of capital expressed as a decimal; and n is the appraisal period in years. The minimum annual net financial return is calculated by dividing the initial investment by the present value annuity factor:

$$CF_{min} = \frac{I}{K},$$

where CF_{min} is the minimum annual net financial return and I is the initial investment. At this level, the present value of all annual financial returns is equal to the initial investment, and the project's net present value is zero. Thus, the calculated indicator represents the financial feasibility threshold for a given cost of capital and appraisal period. Methodologically, this approach is consistent with the principle of discounting future cash flows used in the financial and economic appraisal of investment projects [4; 5].

The calculations were performed for appraisal periods of 15 and 20 years and costs of capital of 6, 8, 10, 12, 14, and 16%. The results are presented in Table 1.

Table 1

Minimum annual net financial return by cost of capital

Cost of capital, %	15-year appraisal period, units per year	20-year appraisal period, units per year
6	10.30	8.72
8	11.68	10.19
10	13.15	11.75
12	14.68	13.39
14	16.28	15.10
16	17.94	16.87

Note. The indicators are calculated for an initial investment of 100 notional units, assuming an equal net financial return received at the end of each year.

The results demonstrate a consistent relationship between the cost of capital and the minimum financial return. For a project with a 20-year appraisal period, an increase in the cost of capital from 6% to 16% raises the required annual return from 8.72 to 16.87 units per 100 units of investment. Thus, at a higher cost of capital, the project must generate almost twice as much net revenue or savings each year.

The appraisal period also has a significant impact. At a cost of capital of 8%, a project with a 15-year appraisal period must generate an annual net financial return of 11.68 units, whereas 10.19 units is sufficient for a 20-year period. This difference arises because a shorter appraisal period provides less time to recover the initial investment. At the same time, simply extending the appraisal period does not eliminate the effect of discounting: cash inflows received further in the future have a lower present value, and therefore dividing the investment by the number of years does not reflect the actual financial burden.

For illustrative purposes, consider a project with an initial investment of EUR 100 million and a 20-year appraisal period. At a cost of capital of 16%, the minimum annual net financial return is EUR 16.87 million. Reducing the cost of capital to 8% lowers this amount to EUR 10.19 million – a decrease of EUR 6.68 million, or 39.6%. At a rate of 6%, the required annual return falls to EUR 8.72 million. These rates are analytical parameters rather than estimates of the actual financing cost of a specific project or the guaranteed effect of participation by an international financial institution.

The results have practical implications for the preliminary preparation and selection of transport projects. If projected net revenues and savings are below the calculated minimum level, the project will not reach the financial break-even point under the relevant financing conditions. This provides a basis for revising the financing structure, securing a grant, guarantee, or budgetary co-financing, increasing the sponsor’s own contribution, or refining the project’s technical parameters.

A negative financial outcome does not preclude the social desirability of a low-carbon investment, which may reduce emissions, generate time savings, and improve safety, accessibility, and energy resilience. The calculated minimum financial return should therefore be considered alongside indicators of economic, social, and environmental performance.

Reducing the cost of capital is one of the key channels through which international institutional involvement can improve the feasibility of transport investment. However, the choice of support instruments should

reflect the financial characteristics of each project. For projects capable of generating sufficient cash flows, long-term lending and risk guarantees may be the principal instruments. Socially important projects with insufficient direct financial returns require a combination of debt financing with a grant or budgetary component.

Thus, the cost of capital and the appraisal period directly determine the minimum annual financial return required to recover transport infrastructure investment. Normalising the calculation to 100 notional units makes it possible to compare projects of different scales and to conduct a preliminary assessment of whether their expected revenues or savings are consistent with the proposed financing conditions. Incorporating this calculation into transport project preparation procedures would support a more informed selection of loan, grant, guarantee, and budgetary instruments while reducing the risk of financing projects whose financial parameters are inconsistent with the applicable financing conditions. Further research should apply this approach to specific types of transport infrastructure, taking into account their cash flows, societal outcomes, and project-specific risks.

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