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ASSESSING THE ECONOMIC EFFICIENCY OF ENTREPRENEURIAL PROJECTS ON THE BASIS OF ARTIFICIAL INTELLIGENCE

Toshpulatov Doniyor Xudoyor o'g'li
Teacher-trainee, Department of Economics and Management, Bukhara State Technical University
ORCID: 0009-0006-9292-4359
Usmonov Farruh Furqatovich
Assistant teacher, Department of Economics and Management, Bukhara State Technical University
ORCID: 0009-0006-8789-2399
Usmonov Sardorbek Beg'amovich
Assistant, Termez State University of Engineering and Agrotechnologies
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ABSTRACT: The article substantiates an approach to assessing the economic efficiency of entrepreneurial projects that combines traditional discounted cash flow indicators with an artificial intelligence (AI) based estimate of project success probability. A hybrid model is proposed in which a scoring module evaluates five groups of non-financial factors (entrepreneurial experience, market demand, financing structure, digital readiness and location), and the resulting probability is integrated into a Monte Carlo simulation of net present value. Testing the model on three model projects showed that the project with the highest traditional NPV (174.7 million soums) has a negative risk-adjusted expected NPV (-199.0 million soums) and a 68 percent probability of loss, while the ranking of the other two projects is preserved. The results confirm that AI-based assessment can improve the quality of investment and lending decisions for small business.

Keywords: entrepreneurial project, economic efficiency, artificial intelligence, net present value, scoring model, Monte Carlo simulation, small business.

INTRODUCTION

Small business is the backbone of the economy of Uzbekistan. According to the National Statistics Committee, in 2025 small business accounted for 52.2 percent of GDP and 61.4 percent of investment in fixed capital, and 82.4 thousand new small enterprises and microfirms were created during the year [9]. Each new enterprise begins with an investment project, and the quality of the decision to finance such a project determines both the survival of the enterprise and the efficiency of the resources of banks and state support funds.

In practice, entrepreneurial projects are assessed mainly with the help of traditional indicators: net present value (NPV), internal rate of return (IRR), profitability index and payback period [2]. These indicators are based on the cash flows planned by the entrepreneur and assume that the project will be implemented as planned. For small and new businesses, however, the main risk is not a moderate deviation of cash flows, but the possibility that the project will stop altogether in its first years. Such a risk depends largely on non-financial factors, which traditional methods do not take into account.

At the same time, the state has set a course for the wide application of AI technologies in the economy. The Strategy for the Development of Artificial Intelligence Technologies until 2030, approved by Resolution PQ-358 of 14 October 2024, provides for the introduction of AI in economic sectors and the formation of "big data" sets in social and economic fields [7], continuing

the goals of the "Digital Uzbekistan-2030" Strategy [8]. This creates the conditions for using AI tools in assessing entrepreneurial projects.

The purpose of this article is to develop a hybrid model for assessing the economic efficiency of entrepreneurial projects that integrates traditional financial indicators with an AI-based estimate of the probability of project success, and to test it on model projects.

LITERATURE REVIEW

The distinction between measurable risk and uncertainty, introduced by F. Knight, explains why the outcomes of new ventures cannot be fully described by planned cash flows [1]. The methodology of discounted cash flow analysis was systematized in the corporate finance literature, in particular by R. Brealey, S. Myers and F. Allen, who also showed the limits of deterministic NPV under uncertainty [2]. E. Altman's multivariate model was one of the first attempts to predict business failure on the basis of a combination of indicators [3]. The development of machine learning, in particular L. Breiman's random forest algorithm [4], made it possible to identify non-linear relationships between the characteristics of firms and their results. H.S. Yoo, Y.L. Jung and S.-P. Jun showed on data from 1,771 projects in South Korea that machine learning models predict the success of SME projects more accurately than qualitative expert evaluation [5], and C. Ünal and I. Ceasu developed reproducible models for predicting startup success [6]. However, in most of these studies, the probability of success is predicted separately from the financial evaluation of the project. The integration of AI-based success probability directly into the calculation of economic efficiency, with regard to the conditions of small business in Uzbekistan, remains insufficiently studied.

RESEARCH METHODOLOGY

The research uses a hybrid model consisting of three blocks. The first block calculates traditional efficiency indicators (NPV, IRR and profitability index) for the cash flows declared in the business plan. The discount rate is taken at 20 percent per year: the key rate of the Central Bank of Uzbekistan, which remained at 14 percent during 2026 [10], plus a 6 percentage point premium for the risk of small business.

The second block is an AI scoring module that estimates the probability of project success p with a logistic function: $p = 1 / (1 + e^{-z})$, where $z = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5$. Here X_1 is the entrepreneur's experience in the sector, X_2 is the confirmed market demand, X_3 is the financing structure (the share of own funds and the debt burden), X_4 is digital readiness (online sales, electronic accounting, payment systems) and X_5 is the location of the business; each factor is normalized on a scale from 0 to 1. In this article the coefficients ($\beta_0 = -2.0$; $\beta_1 = 1.2$; $\beta_2 = 1.5$; $\beta_3 = 0.9$; $\beta_4 = 0.8$; $\beta_5 = 0.6$) are set for illustration; in practical use they are to be trained by machine learning methods (logistic regression, random forest or gradient boosting) on historical data about bank loans and the results of enterprises.

The third block is a Monte Carlo simulation (10,000 iterations). In each iteration, annual cash flows are generated with a normal distribution around the planned values, and with probability (1 - p) the project is assumed to fail: it operates for two years at 70 percent of the planned cash flow and then closes with partial recovery of the investment through the sale of assets. The results are the expected NPV (eNPV), the probability of loss and the 5th percentile of NPV (the value at risk). The method was tested on three model projects of a typical scale for small business: A (trade), B (manufacturing) and C (digital services); the calculations were carried out in Python.

ANALYSIS AND RESULTS

The results of the calculations for the three model projects are presented in Table 1.

Table 1. Traditional and AI-adjusted efficiency indicators of model projects

Indicator	Project A (trade)	Project B (manufacturing)	Project C (digital services)
Investment, million soums	800	1,500	600
Planned annual cash flow, million soums	300	560	235
NPV (r = 20%), million soums	97.2	174.7	102.8
IRR, %	25.4	25.2	27.6
Profitability index	1.12	1.12	1.17
AI score z	1.43	-0.29	1.45
Probability of success p	0.81	0.43	0.81
Expected NPV (eNPV), million soums	38.9	-199.0	50.6
Probability of loss, %	24.6	68.0	26.9
5th percentile of NPV, million soums	-223.0	-684.2	-207.3
Rank by NPV / by eNPV	3 / 2	1 / 3	2 / 1

Source: calculated by the authors.

According to the traditional indicators, all three projects are efficient: NPV is positive and IRR exceeds the discount rate. By the absolute value of NPV, Project B is the most attractive (174.7 million soums), followed by Projects C and A. It is this ranking that a bank or a support fund would rely on if it used only the business plan indicators.

The AI scoring module shows a different picture. Project B has weak non-financial characteristics: little sector experience of the entrepreneur, unconfirmed demand, a high share of borrowed funds and low digital readiness. As a result, its probability of success is only 0.43, compared to 0.81 for Projects A and C. When this probability is included in the Monte Carlo simulation, the expected NPV of Project B becomes negative (-199.0 million soums) and the probability of loss reaches 68 percent. Projects A and C remain efficient after the adjustment, and Project C, with the highest IRR and the strongest digital readiness, becomes the leader.

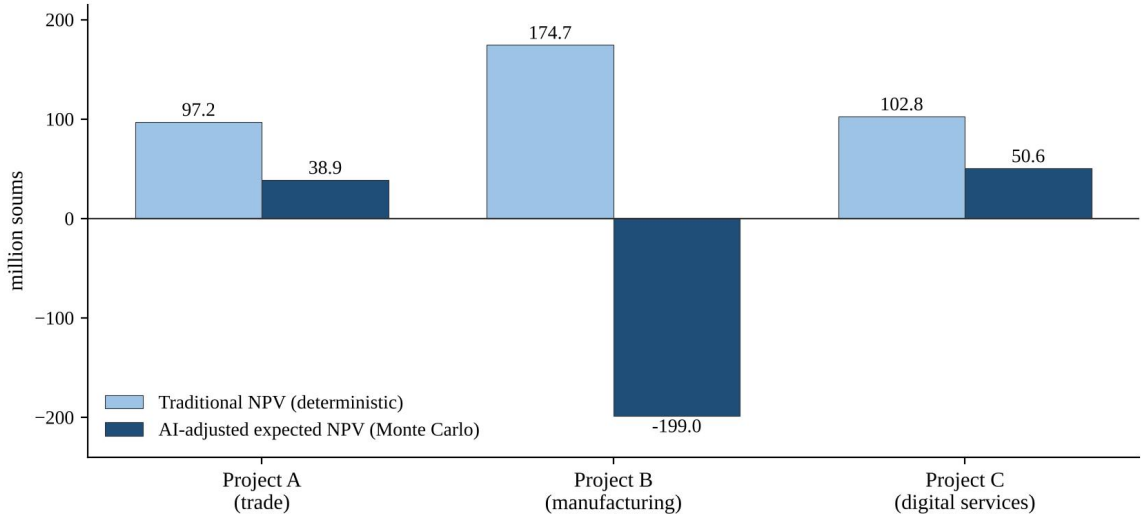


Figure 1. Comparison of traditional NPV and AI-adjusted expected NPV of model projects

Figure 1 shows that the AI adjustment reduces the estimated efficiency of all projects, but to very different degrees: for Projects A and C the reduction is 50-60 percent, while for Project B the sign of the result changes. This means that the deterministic NPV overestimates the efficiency of projects with weak non-financial foundations most of all, and these are exactly the projects that most often fail in practice.

Based on the results, a mechanism for applying the hybrid model in the system of supporting entrepreneurship is proposed. First, the data needed for the scoring module (tax reports, credit history, registration data and the results of previously financed projects) can be obtained from existing state information systems, in line with the formation of "big data" sets provided for by the AI Strategy [7]. Second, the model should be used as a decision support tool rather than a replacement for the expert: projects with a high traditional NPV but a low probability of success should be sent for additional review or offered mentoring and training before financing. Third, the model should explain its estimates, so that the entrepreneur knows which factors lowered the score and can improve them.

CONCLUSIONS AND RECOMMENDATIONS

The study shows that traditional indicators of economic efficiency (NPV, IRR, profitability index) do not take into account the risk of the early failure of entrepreneurial projects, which is determined largely by non-financial factors. The proposed hybrid model integrates an AI-based estimate of the probability of success into the Monte Carlo simulation of NPV. Testing on three model projects showed that the project with the highest traditional NPV turns out to be inefficient after the adjustment (eNPV of -199.0 million soums, probability of loss of 68 percent), while projects with a strong combination of experience, demand and digital readiness remain efficient.

The following recommendations are proposed: first, commercial banks and state funds supporting entrepreneurship should supplement the assessment of business plans with an AI scoring module and use the expected NPV and the probability of loss alongside the traditional indicators; second, the coefficients of the model should be trained on the national data of previously financed projects, and the model should be regularly re-validated; third, digital readiness should be included as a separate criterion in the evaluation of projects, since it substantially increases the probability of success; fourth, entrepreneurs with a low score should be offered training and mentoring rather than

simply refused; fifth, the use of such models should comply with requirements for data protection and the transparency of decisions.

The limitation of the study is that the coefficients of the scoring module were set for illustration and the model was tested on model projects. Future research should train the model on real data about loans and the results of small businesses in Uzbekistan and compare the accuracy of different machine learning algorithms.

REFERENCES

1. Knight, F.H. (1921). Risk, Uncertainty and Profit. Boston: Houghton Mifflin.
2. Brealey, R.A., Myers, S.C., & Allen, F. (2020). Principles of Corporate Finance (13th ed.). New York: McGraw-Hill Education.
3. Altman, E.I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. The Journal of Finance, 23(4), 589-609.
4. Breiman, L. (2001). Random Forests. Machine Learning, 45(1), 5-32.
5. Yoo, H.S., Jung, Y.L., & Jun, S.-P. (2023). Prediction of SMEs' R&D Performances by Machine Learning for Project Selection. Scientific Reports, 13. DOI: 10.1038/s41598-023-34684-w.
6. Ünal, C., & Ceasu, I. (2019). A Machine Learning Approach Towards Startup Success Prediction. IRTG 1792 Discussion Paper 2019-022. Berlin: Humboldt-Universität zu Berlin.
7. Resolution of the President of the Republic of Uzbekistan "On approval of the Strategy for the Development of Artificial Intelligence Technologies until 2030", No. PQ-358, October 14, 2024 [Electronic resource]. URL: https://lex.uz/docs/-7158604 (accessed: 05.11.2026).
8. Decree of the President of the Republic of Uzbekistan "On approval of the Digital Uzbekistan-2030 Strategy and measures for its effective implementation", No. PF-6079, October 5, 2020 [Electronic resource]. URL: https://lex.uz (accessed: 05.11.2026).
9. National Statistics Committee of the Republic of Uzbekistan. Main indicators of small business entities in the Republic of Uzbekistan for January-December 2025. Press release, 26.01.2026 [Electronic resource]. URL: https://stat.uz (accessed: 05.11.2026).
10. Central Bank of the Republic of Uzbekistan. Press releases on the key rate decisions, 2026 [Electronic resource]. URL: https://cbu.uz (accessed: 05.11.2026).