*Corresponding Author's Email: revan622@mail.ru
Proceedings of the International Conference on Management, Economics and Finance
Vol. 2, Issue. 1, 2025, pp. 1-11
DOI: https://doi.org/10.33422/icmef.v2i1.1171

ISSN: 3030-1238 online

Methods for identifying and mitigating investment project risks

Bashar Shirinov

Azerbaijan University of Architecture and Construction, Department of Business Economics and Management, PhD in Economics, Associate Professor, Baku, Azerbaijan

Abstract

The purpose of identifying risks in investment projects is not only to determine which risk areas exist for a specific project, but also to assess the significance of these risks for the project, that is, the probability of their occurrence and, accordingly, their more serious consequences for the success of the entire project.

Investment risk is a component of general financial risk and represents the probability of financial losses, loss of at least part of the investment, non-return of investment or additional investment costs. In general, the nature of investment risk can be classified according to various criteria.

In the process of qualitative analysis of project risks, it is important to study the causes of their occurrence and the factors affecting their dynamics, which is associated with the description of possible damage from the manifestation of project risks and the assessment of their value.

Quantitative analysis of the assessment of the effectiveness of project risks is carried out mainly using tools from the theory of probability, mathematical statistics and the theory of operations research.

The author of the article identified ways to reduce risks in investment projects in terms of financing, examined risk management methods, analyzed the indicators used in assessing risks in investment projects: mean square deviation, coefficient of variation, beta (β) coefficient and the use of expert methods, and compared the effectiveness of two investment projects (A and B) by areas of manifestation using variation indicators.

Keywords: investment projects; project risks; investment risks; standard deviation; coefficient of variation

1. Introduction

A necessary condition for a deep structural restructuring of the country's economy and ensuring its sustainable economic growth is an increase in the volume of investments and their efficiency. The development of both the economy as a whole and individual enterprises is impossible without increasing economic potential, introducing modern technologies, and expanding the level of production activity, the implementation of which is an investment process.

The processes of formation of market relations in our republic have significantly changed the characteristics and conditions for the implementation of investment activities. Ensuring freedom of entrepreneurship and independence in the use of one's own financial resources, creating legal and economic conditions for attracting capital from Azerbaijani and foreign investors, globalization of production and financial activities of business entities, and the emergence of other factors have created the need to radically improve the economic reforms that existed in previous periods. This, in turn, requires fundamental changes in the methodology and techniques of investment analysis.

The practical requirement for improving the methods of assessing investment projects is determined by the strategic role of long-term capital-generating investments both in the socio-economic development of the country as a whole and its individual regions, and in the activities of specific commercial organizations. The current low level of investment in the real sector is due to a number of reasons, one of which is the insufficiently convincing justification of the effectiveness of many investment projects for investors.

Assessment of the economic effectiveness of investments allows you to compare possible options for investing in technical, technological, organizational and other measures developed in each specific project. Before investing funds (investments), entities engaged in investment activities must assess their financial capabilities and results, that is, they must go through a multi-stage pre-investment process from the development of an investment idea to assessing the effectiveness of investments and making a decision. Assessment and justification of financial results and their effectiveness allows you to make the best decision.

Risk management methods

Risk management methods include: diversification, risk avoidance (insurance), compensation, localization.

Diversification, as mentioned above, is one of the most important areas of risk reduction. To reduce the risk of an organization's (enterprise's) activities, it is desirable to produce such goods and services, the demand for which changes in the opposite direction. Risk sharing can be organized both in the supplier and consumer space through diversification (lkington, R., & Fitzgerald, E. (2019).

Risk insurance occupies a special place among the methods of risk avoidance (insurance). Insurance of investments against political risks, insurance of investments against commercial and financial risks are possible.

Risk compensation is largely similar to insurance. It involves the creation of certain reserves: financial, material, information. Financial reserves can be created by allocating additional funds to cover unforeseen expenses. Material reserves mean the creation of a special safety stock of raw materials, materials and components. Obtaining additional information, for example, conducting more detailed marketing research, can be considered an information reserve.

Risk localization refers to the identification of certain types of activities that can lead to risk localization. For example, the creation of a separate company or subsidiary of a company to implement a new risky IP. In addition, the composition of participants can be changed to increase the stability of the IP and reduce its risk, in particular by including venture firms specializing in financing risky, innovative projects.

Ways to reduce risks in investment projects in terms of financing

After completing the work for which the reserve is allocated for emergencies, it is necessary to compare it with the planned and actual distribution of unforeseen circumstances. The unused part of the allocated reserve can be returned to the project reserve. It should be noted that part of the reserve should always be in the hands of the project manager, and the rest should be managed by other project participants in accordance with the contract (Gryshko et al., 2020).

Neutralization of personal risks (or private risk method). Personal risks are understood as risks associated with the implementation of individual stages (works) of the project, but do not directly affect the project as a whole.

The most important specific risks of the project and measures to neutralize them can be assessed by a method consisting of the following (Mammadova,2022):

1. The risk that is of greatest importance for the project is taken into account.

2. The cost overrun is determined taking into account the probability of a negative event.

3. A list of possible measures aimed at reducing the significance of the risk (reducing its probability or threat) is determined.

4. Additional costs for the implementation of the proposed measures are determined.

5. The costs required for the implementation of the proposed measures are compared with the possible cost increases due to the occurrence of the risk event.

6. A decision is made on the application of anti-risk measures.

7. The risk analysis process is repeated for the next most important risk.

At the same time, this method does not directly determine the risk of implementing the entire project. This method is based on an expert risk assessment carried out at the identification stage, but it is based on detailed information about the project, including the implementation schedule, key participants, the cost of all types of resources for each task, etc.

Risk reduction in terms of financing. The project financing plan, which is an integral part of the project plan, must take into account the following types of risks: the risk of non-implementation of the project, tax risk, risk of non-payment of debts, risk of construction not completed. Let's look at the essence of these risks and some ways to take them into account when preparing a financial plan (Newland, 2018).

Risk of non-implementation of the project. Investors must be sure that the expected income from the project will be sufficient to cover expenses, repay debts and ensure return on investment. Such a guarantee requires maximum flexibility from project participants. If the calculations within the framework of a short feasibility study give a positive result from the assessment of the future project, then it is advisable to make concessions with the investor on some issues. Thus, at this stage, it is problematic to obtain a solid guarantee of dividend payment. At the same time, if it is known, for example, that there is already a large order for the purchase of project products, there is no need to insist on additional guarantees on this issue.

Tax risk includes:

- inability to use tax benefits provided for by current legislation for one reason or another;

- changes in tax legislation;

- decisions of the tax service that reduce tax advantages. As a rule, investors protect themselves from tax risk through appropriate guarantees included in contracts and agreements.

Risk of non-payment of debts. Even successful projects may face a temporary decrease in income due to a short-term decrease in demand for the project's product (work, service) or a decrease in its prices. To protect yourself from such fluctuations, the planned annual income from the project should strictly cover the maximum annual payments on debts. In this case, such risk reduction measures as the formation of reserve funds, the possibility of additional financing of the project, withholding a certain percentage of income from the sale of project products (works, services) are used.

Risk of incomplete construction. As a rule, investors are concerned about the risk of additional costs associated with the untimely completion of the construction stage (phase) of the project due to inflation, exchange rate fluctuations, environmental problems, government regulations. Therefore, before construction begins, project participants must agree on guarantees for its timely completion. The result of the work of project analysts is a plan reflecting the totality of project risks, including financial, as well as project budgets.

Everything that has been said about reducing the risk of implementation by individual entrepreneurs applies to financial investments to a large extent. In general, ways to reduce the risk of financial investments in securities include their prevention, storage, transfer and risk reduction.

Avoidance simply means avoiding a transaction that involves risk. Risk retention means leaving the risk to the investor, his responsibility. Risk transfer means that the investor transfers the responsibility to the insurance company. Risk reduction involves reducing the probability and volume of losses, which is achieved mainly by diversifying the securities portfolio.

To protect investors from risk when investing in securities, hedging methods are used, that is, to a certain extent, insuring financial transactions related to risky investments, including securities. In developed countries, hedging in the securities market is understood as a system of concluding futures contracts and transactions that take into account possible future changes in securities prices in order to reduce the risk of consequences.

Indicators used in assessing risks in investment projects

Investment risks are assessed for each investment project and financial instrument. They are measured by various methods, calculations (Shirinov & Hasanov, 2024) :

- root mean square deviation;

- coefficient of variation;

- β- coefficient;

- expert method.

The standard deviation is considered the most common indicator for assessing the level of investment risks (Shirinov & Mahas, 2023; Laamarti,2024). The calculation of the standard deviation allows us to take into account the variability of the expected return on various investments. Let us consider the mechanism for assessing investment risks based on the determination of the standard deviation (table-1).

Table 1: Probability distribution of expected return for two investment projects

Possible values of investment market conditions	Investment project A			Investment project B		
	Estimated income, thousand manats.	Probability value	Amount of expected income, thousand manats	Estimated income, thousand manats.	Probability value	Amount of expected income, thousand manats
High	3600	0,25	900	4800	0,20	960
Medium	3000	0,50	1500	2700	0,60	1620
Low	1200	0,25	300	600	0,20	120
Total	—	1,0	2700	—	1,0	2700

Note: The table was compiled by the author.

To determine the standard deviation, it is first necessary to calculate the mean and variance. In the process of assessing the possible size of financial losses from investment activities, their absolute and relative indicators are used. The absolute amount of financial losses associated with investment risk is the amount of damage incurred by the investor (or potentially possible) as a result of the occurrence of an unfavorable event characteristic of this risk. The relative amount of financial losses associated with investment risk is the ratio of the amount of damage to the main indicator (for example, the amount of expected return on investment, the amount of invested capital, etc.).

Since the information on the amount of expected return in both projects is provided individually (high, medium, low), the simple formula of the arithmetic mean is used, first. for project A, let's calculate the average amount formula (1):

$$\bar{x}_A = \frac{\sum x}{n} \qquad (1)$$

$$\bar{x}_A = \frac{\sum x}{n} = \frac{2700}{3} = 900 th.manats$$

Let's calculate the arithmetic average quantity for project B using formula (2):

$$\bar{x}_B = \frac{\sum x}{n} \qquad (2), \quad \text{(Shirinov \& Mahas, 2023)}$$

$$\bar{x}_B = \frac{\sum x}{n} = \frac{2700}{3} = 900 th.manats$$

Although the average amount of expected income in both projects is the same, the range of variation and the standard deviation will be different.

Comparing the data on individual investment projects, it can be seen that the estimated income for project A is between 1200 and 3600 thousand manats. The range of variation for project A is given by formula (3):

$$R_A = x_{\max} - x_{\min} \qquad (3)\ ,$$ (Shirinov & Hasanov, 2024).

$$R_A = 3600 - 1200 = 2400 th.manats$$

The total expected revenue for project B is also 1350 thousand manat, but the variation in the estimated revenue varies from 300 to 2400 thousand manat.

The range of variation for project B is given by formula (4):

$$R_B = x_{\max} - x_{\min} \qquad (4),$$

$$R_B = 4800 - 600 = 4200 th.manats\ .$$

Despite such a simple comparison, it allows us to conclude that the risk of implementing investment project A is significantly lower than the risk of project B, where the variability of the estimated return is higher.

Based on the information in Table 1, let us calculate the variance of the expected return for each Investment project (Table 2).

Since the data are given individually, we must use simple formulas for the variance formula (5):

$$\sigma_A^{\,2} = \frac{\sum (x - \bar{x}\ )^2}{n} \qquad (5)\ ,$$ (Shirinov & Mahas, 2023)

To calculate the variance for each Investment project, we must first calculate the average quantity (table 2).

Table 2: Example of calculating expected returns on two investment projects

Possible values of investment market conditions	**Investment project A**			**Investment project B**		
	Amount of expected income, thousand manats	$x - \bar{x}_A$	$\left(x - \bar{x}_A\right)^2$	Amount of expected income, thousand manats	$x - \bar{x}_B$	$\left(x - \bar{x}_B\right)^2$
High	900	0	0	960	60	3600
Medium	1500	600	360000	1620	720	518400
Low	300	600	360000	120	-780	608400
Total	2700	-	720000	2700	-	1130400

Note: The table is compiled by the author

Since the data is presented individually, we need to use simple formulas for variation indicators:

First, let's calculate the expected return for each Investment project:

The expected average return for project A:

$$\bar{x}_A = \frac{\sum x}{n} = \frac{2700}{3} = 900 th.manat$$

For project B, the expected average revenue is:

$$\bar{x}_B = \frac{\sum x}{n} = \frac{2700}{3} = 900 th.manats$$

For project A, the variance is equal to,

$$\sigma_A{}^2 = \frac{\sum (x - \bar{x}_A)^2}{n} = \frac{720000}{3} = 240000$$

For project B, the variance is equal to,

$$\sigma_B{}^2 = \frac{\sum (x - \bar{x}_H)^2}{n} = \frac{1130400}{3} = 724800$$

Standard deviation:

For project A, the standard deviation is equal to,

$$\sigma_A = \sqrt{\frac{\sum (x - \bar{x}_A)^2}{n}} = \sqrt{240000} = 489{,}9$$

For project B, the mean squared deviation is equal to,

$$\sigma_B = \sqrt{\frac{\sum (x - \bar{x}_B)^2}{n}} = \sqrt{724800} = 851$$

The coefficient of variation (coefficient of variation) allows us to determine the level of risk when the average expected return indicators differ from each other. The coefficient of variation (coefficient of variation –V) is calculated using the following (from formula 6):

$$V = \frac{\sigma}{\bar{x}} \cdot 100\% \quad . \qquad (6) \text{ (Mammadov et al., 2024)}$$

In our example, the coefficient of variation for project A is equal to,

$$V_A = \frac{\sigma}{\bar{x}} \cdot 100\% = \frac{489{,}9}{900} \cdot 100\% \approx 54.4\%$$

The coefficient of variation for project B is equal to,

$$V_B = \frac{\sigma}{\bar{x}} \cdot 100\% = \frac{851}{900} \cdot 100\% \approx 94.6\%$$

As can be seen from our calculation based on the data in Tables 1 and 2, although the average amount in both projects is 900 thousand manat, the standard deviation and coefficient of variation for project A are smaller than for project B, meaning that project A is less risky than project B.

An investment project is a system of organizational, legal, settlement and financial documents necessary for the implementation of any actions related to the placement or use of capital in various sectors of the economy in order to increase its use or describe such actions. An investment project is completed upon reaching a given rate of return or other indicator reflecting investment goals.

The β-coefficient (beta coefficient or beta) allows you to assess the risk of an individual investment project in relation to the risk level of the investment market as a whole. This indicator is mainly used to analyze the riskiness of investments in individual securities (compared to the systematic risk of the entire stock market). This indicator is calculated by the following formula (7):

$$\beta = \frac{P\sigma_f}{\sigma_t} \quad . \qquad (7)$$

Here,

- P-is the correlation between the return on individual types of securities and the average level of return on equity instruments as a whole;

- σf- is the standard deviation of returns on the stock market as a whole;

- σt- is the standard deviation of returns for an individual type of security.

The risk level of individual securities is determined based on the following The current values of the β-coefficient are given in table 3.

Thus, along with the increase in the value of the β-coefficient, the level of systematic investment risk also increases.

Table 3: Assessment of the risk level in individual investment projects according to the β-coefficient

β-coefficient value	Security risk level
$\beta = 1$	Medium
$\beta > 1$	High
$\beta < 1$	Low

Note: The table was compiled by the author

The expert method of risk assessment is carried out when the investor does not have the necessary information or statistical data to calculate the above indicators, or there is no analogue of the planned investment project. This method is based on a survey of qualified specialists (investment, insurance, financial managers) and the appropriate mathematical processing of the results of this survey. In order to obtain a more detailed description of the level of investment risk for the project, the survey should be focused on certain types of risks characteristic of a particular investment project (Mammadov et al., 2021).

The results of risk assessment for individual investment projects allow us to quantitatively assess their levels. For these purposes, the following assessment criteria are used: risk-free investments; investments with an acceptable level of risk; investments with a critical level of risk;investments with a catastrophic level of risk.

Each level is characterized by a different probability of loss of invested funds and potential profitability.

Risk-free investments are investments in which there is virtually no risk of losing the invested funds. In reality, it is impossible to be absolutely risk-free, but some instruments are considered as close as possible to this concept. Often, government bonds are called risk-free assets.

For investors looking for an acceptable level of risk, there are several options that combine sufficient returns with moderate risk. These options include bank deposits, bonds, moderate-risk mutual funds, as well as investments in real estate and gold.

Investments with a critical level of risk involve a high probability of losing the invested funds, but also a potentially high return. Such investments include: venture investments in startups, investments in cryptocurrencies, derivatives trading (futures, options), high-yield bonds, investments in financial pyramids, and initial public offerings of some types of stocks.

Investments with a catastrophic level of risk are investments in which the probability of losing all or most of the invested amount is very high. Such investments include investments in financial pyramids, investments in certain types of cryptocurrencies (especially at the initial stage, without sufficient diversification), as well as participation in dubious projects with uncertain prospects and incompetent organizers.

Conclusion

A specific feature of the current stage of economic development is the shift of the center of gravity in investment activity to the level of enterprises and organizations and the development of self-financing on this basis.

In modern conditions, the responsibility of all subjects of investment activity for the selection of the most progressive options in the field of investment projects, the reliability of methods for assessing their effectiveness should be increased.

The purpose of assessing the effectiveness of investment projects is to obtain information that allows drawing conclusions about the feasibility of the investment. Currently, the problem of choosing the best of alternative investment projects is particularly relevant. This problem is faced by both individual enterprises, investors, and regions (represented by state bodies) when forming investment portfolios.

The practical requirement for improving methods for assessing investment projects is determined by the strategic role of long-term capital-generating investments both in the socio-economic development of the country as a whole and its individual regions, and in the activities of specific commercial organizations. The current low level of investment in the real sector is due to a number of reasons, one of which is the insufficiently convincing justification of the effectiveness of many investment projects for investors.

Assessment of the economic efficiency of investments allows comparing possible options for investing in technical, technological, organizational and other measures developed in each specific project. Before investing funds (investments), entities engaged in investment activities must assess their financial capabilities and results, that is, they must go through a multi-stage pre-investment process from the development of an investment idea to assessing the effectiveness of investments and making a decision. Assessment and justification of financial results and their effectiveness allows you to make the best decision.

Determining the risks of investment projects involves determining the composition and content of possible risks. Accordingly, the composition and content of risks are determined for individual investments, then for investment groups, and finally for the totality of investments as a whole.

It is possible to manage the risks of an investment project with the help of anti-risk measures. It is important to choose the right methods to reduce project risk, because it is the correct management of risks that allows you to minimize losses that may arise during the implementation of an investment project, as well as reduce the overall risk of the project.

References

Elkington, R., & Fitzgerald, E. (2019). "Project Risk Management: A Practical Guide to Managing Uncertainty." International Journal of Project Management, 37(5), 748-758. doi:10.1016/j.ijproman.2019.01.005.

Gryshko ,V,, Alizada, Sh,, Boldyrieva, L., Hunchenko, M. (2020). Construction Management Based on European Experience of Using Smart-City Technology , p. 607–614

Hillson, D., & Simon, P. (2020). Practical Project Risk Management: The ATOM Methodology. 3rd ed. Vienna, Austria: Management Concepts Press.

Kariuk, A., Pashynskyi, V., Pashynskyi, M., Mammadova, F.(2022). Methods of Probabilistic Assessment of Building Enclosing Structures Thermal Reliability. Lecture Notes in Civil Engineering, pp. 179–189

Laamarti ,Y,, Dedov, E., Kramlikh ,O. (2024). Methods of forecasting stocks of construction materials during deliveries - Vestnik 19, № 2

López, M. F., & Pérez, A. M. (2020). "Agile Risk Management in Projects: A Review." International Journal of Information Technology Project Management, 11(2), doi:10.4018/IJITPM.2020040104.

Mammadov, M., Mammadova, F., Alizade, S.(2021.) Strategic Management, Baku- "Tahsil" ELM,

Mammadova, K. (2022),.Strategic management and leadership - Teaching materials, Baku.

Mammadov, M., Yadigarov, T., Mammadova, F., Alizade, Sh., Nagdiyev, O., Safarova, G., Aliyev, A..(2024) An economic and mathematical modeling for risk assessment of innovative activities an enterprise in oil and gas industry. SOCAR Proceedings, , pp. 139–146

Mamadova, A., Novruzova, A., Shahla, A., Huseynova, Ofelya, N., Matanat ,L, Azizova, R., Aliyeva, (2019).Features of education financing in developing countries, - Revista Espacios, , Vol. 40 (№ 26).

Miller, R., & Lessard, D. (2000). "Understanding and Managing Risks in Large Projects." International Journal of Project Management, 18(5), 469-482. 7863(99)00056-5.

Newland, K. (2018). "The Risk Management Process: A Practical Guide for Managing Projects." Project Management Journal, 49(3), 5-14. doi:10.1177/8756972818777924.

Pinto, J. K. (2019). "Project Risk Management: Why It Matters and How to Get It Right." Business Horizons, 62(2), doi:10.1016/j.bushor.2018.11.004.1

Raz, T., Hiller, N. (2005). "Risk Management and Project Success: A Review of the Literature." International Journal of Project Management, 23(5), 359-365. doi:10.1016/j.ijproman.2005.01.005.

Shirinov, B.,Hasanov K. (2024). Risk assessment methods of investment projects, Economics and Region, № 4 (95) , Yuri Kondratyuk National University

Shirinov, B., Nataliia, M .(2023) Forecasting Sales Volume in Construction Companies ICBI 2022: Proceedings of the 4th International Conference on Building Innovations, pp. 825–830 , https://link.springer.com/chapter/10.1007/978-3-031-17385-1_70

Stough, H., Chao, M. (2018). "Using Artificial Intelligence to Improve Project Risk Management." Computers in Industry, 99, 113 121. doi:10.1016/j.compind.2018.02.004.

Westerveld, E. (2003). "The Project Excellence Model: Linking Success Criteria and Critical Success Factors." International Journal of Project Management, 21(6), 411-418. doi:10.1016/S0263-7863(02)00069-4.

Zhang, H., & Xu, J. (2019). "Modeling the Impact of Risk Management on Project Success: A Study in the Construction Industry." Engineering, Construction and Architectural Management, 26(7), 1035-1048. doi:10.1108/ECAM-10-2018-0361.

Zhang, Y., Li, Y. (2020). "Risk Assessment in Project Management: A Review of Literature." Journal of Risk Research, 23(4), 485-501. doi:10.1080/13669877.2018.1542098.