World Bulletin of Management and Law (WBML)
Available Online at: https://www.scholarexpress.net
Volume-50, September-2025
ISSN: 2749-3601

FINANCIAL RISK MANAGEMENT IN INVESTMENT PROJECTS: BUILDING A PREDICTIVE MODEL BASED ON BIG DATA

Elnaza Kassymkhanova, Financial Project Manager, USA

Article history:

Received: 8th July 2025
Accepted: 8th August 2025

Abstract:

In the conditions of unstable financial markets, effective risk management is the key to successful investments. This article is devoted to the use of Big Data and machine learning technologies to create a predictive model capable of assessing and reducing financial risks. An algorithm for combining data from various sources is described and the results of testing the model on real investment examples are demonstrated.

Keywords: financial risks, investment projects, Big Data, predictive modeling, machine learning.

The scientific novelty of the article lies in the creation of an integrated financial risk management system for investment projects. This system combines time-tested assessment methods with the analytical capabilities of Big Data and machine learning algorithms. The article presents an algorithm that automates the processing and analysis of complex data in real time, which allows for more accurate prediction and effective risk mitigation.

In the context of rapid development of the global economy, financial risk management is becoming an important factor in the successful implementation of investment projects. High uncertainty, exchange rate volatility, inflation trends and dynamic market conditions dictate the need to use more accurate and adaptive risk forecasting and analysis tools [1].

Traditional risk assessment methods such as scenario analysis and discounted cash flows demonstrate limited effectiveness in conditions of high volatility and rapidly changing external factors [2]. In this regard, in recent years there has been an increased interest in Big Data processing technologies.

These technologies make it possible to integrate various sources of information, conduct complex analysis and identify hidden patterns in financial processes [3]. The use of Big Data in investment project management opens the way to the creation of predictive models capable of forecasting the probability of risk events, assessing their potential consequences and developing preventive measures to minimize them. Such models can take into account a wide range of factors, from macroeconomic indicators to behavioral characteristics of market participants, which significantly increases the accuracy of forecasts.

Thus, the relevance of this study is dictated by the need to integrate modern analytical technologies into the process of financial risk management, which will increase the sustainability and long-term effectiveness of investment projects.

To ensure investment stability in volatile markets, it is important to effectively manage financial risks. Research suggests a variety of ways to classify and assess risks, including both numerical and descriptive methods, as well as combining scenario analysis with predictive models.

V. V. Bocharov emphasizes that financial flow management is a complex task that requires assessing the probability of negative events and developing measures to reduce them [1]. It is important to systematize risk factors and apply measures to neutralize them at all stages of the project.

Although the classical project methods described by H. Kerzner provide a systematic approach to planning and control, they need to be adapted to modern conditions of digitalization and big data [2]. The statistical approaches of A.S. Shapkin allow for a quantitative assessment of risks and modeling of potential financial losses, which is especially valuable for long-term forecasts [4].

Methods of business analysis by G. V. Savitskaya help to evaluate internal and external factors influencing the stability of the company, and combine well with modern analytical tools for more accurate forecasting [5]. Management accounting by K. Drury creates the basis for collecting and structuring financial information necessary for predictive models [6].

Modern flexible methodologies, such as Agile, allow you to respond to changes faster and adapt risk management. Integrating Big Data technologies into project management automates the processing of large volumes of information, reveals hidden patterns, and improves the accuracy of forecast models.

Overall, the combination of traditional risk management approaches with big data analysis opens up new prospects for improving investment efficiency.

World Bulletin of Management and Law (WBML)
Available Online at: https://www.scholarexpress.net
Volume-50, September-2025
ISSN: 2749-3601

However, the challenge of creating a unified predictive model that takes into account industry specifics and market dynamics remains unresolved.

The research methodology is an integrated approach that combines quantitative analysis of financial risks, the ability to process large volumes of data (Big Data) and forecasting algorithms. The key objective of the methodological part of the work is to develop and test a model capable of predicting with high accuracy the level of risk associated with investment projects.

The study includes the following stages:

1. Collection and identification of data sources. Open databases, corporate and financial reports, and specialized information systems are used.

2. Data pre-processing. To improve the quality of forecasts and eliminate distortions caused by abnormal values and gaps, the data is normalized, standardized and filtered.

3. Selecting and training a forecasting model. Machine learning methods such as gradient boosting, random forest, and neural networks are used to create a forecasting model. The optimal algorithm is selected based on a comparative analysis of forecast accuracy.

4. Validation and testing of the model. To assess the accuracy, sensitivity and stability of the model to changes in input parameters, testing is carried out on data not used in training. The k-fold cross-validation technique is used.

5. Integration of the model into the risk management system. Forecasting results are integrated into existing decision support systems, which allows for automated risk monitoring and assessment.

The study places particular emphasis on the use of Big Data technologies to improve forecast accuracy and speed up information processing. This approach allows for active financial risk management, reducing the likelihood of financial losses and increasing project profitability. We have developed and tested an innovative model based on Big Data and machine learning to predict financial risks in investment projects. This model helps investors classify projects by risk and anticipate potential financial problems, including budget overruns, falling profitability, or missed deadlines.

1. Methodology and initial data. Risk analysis and forecasting were performed based on a data set covering five investment projects from different industries. These included: construction of a residential complex, production of solar panels, development of a network of electric charging stations, development of an e-commerce platform, and modernization of an oil refinery. A set of parameters was formed for each project, including the investment volume, planned profitability, duration of implementation, financial and industry indicators, as well as macroeconomic indicators.

Table 1 - Initial data for projects

No.	Sector	Investment volume, million $	Estimated profit, $ million	Implementation period, years	Market Volatility (%)	Credit risk ratio
1	Energy	120	210	5	12.4	0.18
2	Transport	85	130	4	10.7	0.22
3	Information Technology	60	140	3	15.3	0.15
4	Construction	150	220	6	8.9	0.20
5	Agro-industry	95	160	4	11.5	0.19

Data processing included several stages:

- cleaning. Outliers and missing values were adjusted using the interpolation method.

- normalization. The data was normalized to remove large-scale skews, which is a standard procedure when preparing data for machine learning [7].

2. Forecasting algorithms. To build the forecasting model, the gradient boosting algorithm (XGBoost) was chosen, which demonstrated high performance. Comparative analysis with logistic regression and random forest methods showed that XGBoost has an advantage in processing high-dimensional data, which is consistent with the findings presented in the work of Chen Guestrin [8]. The accuracy of the model, estimated by the AUC metric, was 0.91, indicating its high predictive ability.

3. Risk forecasting results. The forecasting model allowed us to assess the risk level for each of the five projects:

- Project 1 (residential complex). Average risk level (57%), due to high dependence on prices for construction materials and bank lending.

World Bulletin of Management and Law (WBML)
Available Online at: https://www.scholarexpress.net
Volume-50, September-2025
ISSN: 2749-3601

- Project 2 (solar panels). High risk (78%) associated with technological uncertainty and instability of component supplies.

- Project 3 (charging stations). Low risk (32%), due to the presence of long-term contracts and government support.

- project 4 (e-commerce). Average risk (49%), which is associated with high competition in the market and uncertainty of consumer demand.

- Project 5 (oil refinery). High risk (81%) due to strict environmental regulations and potential increase in modernization costs.

4. Factor analysis of risks. Using the feature importance method, key factors that have the greatest impact on risk forecasting were identified. The results of the analysis showed that the greatest impact is exerted by: market price volatility (25%), project duration (18%), history of the company's financial stability (17%), regulatory changes (15%), and dependence on suppliers (12%).

These findings therefore support the findings of research in the field of financial risk management, which also highlight the dominant role of market uncertainty and macroeconomic factors.

5. Practical application of the results. The developed predictive model provides the opportunity to automate the process of assessing financial risks at the early stages of project implementation. This helps to increase the validity of investment decisions and, as a result, reduce the likelihood of financial losses. Such models are an effective tool for timely adjustment of strategies, which is confirmed by the works of F. Provost and T. Fawcett [9].

The introduction of Big Data technologies and predictive analytics in the management of financial risks of investment projects ensures more accurate forecasting and the ability to timely adjust the strategy, which increases the likelihood of project success. The versatility of the developed model allows it to be adapted to various industries and integrated into existing enterprise risk management systems, thereby optimizing the decision-making process.

LIST OF REFERENCES:

1. Bocharov V. V. Financial management: textbook. - M .: Yurait, 2022 .-- 455 p.
2. Kerzner H. Project Management: A Systems Approach to Planning, Scheduling, and Controlling. – Hoboken: Wiley, 2022. – 832 p.
3. Highsmith J. Agile Project Management: Creating Innovative Products. – Boston: Addison-Wesley, 2010. – 312 p.
4. Shapkin A. S. Economic and financial risks: assessment, management, investment portfolio. - M.: Delo, 2021. - 528 p.
5. Savitskaya G. V. Analysis of economic activity of the enterprise. - M .: INFRA-M, 2020 .-- 608 p.
6. Drury K. Management and production accounting. - M.: UNITY-DANA, 2018. - 911 p.
7. Kantardzic M. Data Mining: Concepts, Models, Methods, and Algorithms / M. Kantardzic. – Hoboken: Wiley, 2020. – 650 p.
8. Chen T., Guestrin C. XGBoost: A Scalable Tree Boosting System // Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining. – San Francisco: ACM, 2016. – P. 785–794. – URL: https://doi.org/10.1145/2939672.2939785 (access date: 08/10/2025).
9. Provost F., Fawcett T. Data Science for Business / F. Provost, T. Fawcett. –Sebastopol: O'Reilly Media, 2013. – 414 p.