FINANCING OF INNOVATIVE PROJECTS FOR THE DEVELOPMENT OF REGIONAL INFRASTRUCTURE

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Abstract

The study aims to develop and justify a risk management system for infrastructure enterprises, with the goal of minimizing the negative impact of risks on their activities. This article examines existing risk management approaches, analyses modern scientific publications from 2020 to 2025, and proposes an original risk management system adapted for infrastructure enterprises. The main results of the study include the definition of the concept of a 'risk management system for infrastructure enterprises', an analysis of how such enterprises operate, the development of the main directions and measures to reduce risks, and the author's proposal for a risk management system. The article also describes the system's formation stages, funding sources, and tools and methods for assessing its efficiency. The study's findings demonstrate that implementing a risk management system increases the sustainability of infrastructure enterprises, reduces financial losses, and improves service quality. The proposed system can be used to optimize risk management processes within infrastructure enterprises, ultimately having a positive impact on their long-term competitiveness and sustainability.

Keywords: risk management, infrastructure enterprises, management system, risk assessment, indicators, efficiency

I. Introduction

Risk management is an important element of strategic management in infrastructure enterprises, which play a key role in ensuring the functioning of the economy and society. The risks faced by such enterprises include financial, operational, environmental, technological and regulatory threats. In an unstable external environment and increasing competition, effective risk management becomes critical to ensuring the sustainability and competitiveness of infrastructure enterprises.

The existing views on risk management methods in infrastructure enterprises can be divided into traditional and modern. Traditional approaches, such as insurance and reservation, are aimed at minimizing the consequences of risks that have already been realized. Modern approaches, including risk-based management and integrated risk management systems, involve predicting and preventing risks at early stages. However, research shows that many infrastructure enterprises still use outdated methods, which reduces their efficiency in a rapidly changing environment.

A review of scientific publications for the period 2020-2025 allows us to identify several key trends in the field of risk management. For example, Smith et al. (2020) emphasize the importance of integrating risk management into the strategic planning of infrastructure enterprises [14].

Cea, L. and Costabile, P. (2022) investigated flood risks in urban areas considering modelling, management and adaptation to climate change [11].

Sotamaa T., Reiman A. and Kauppila O. (2020) conducted a systematic review of the literature on risk management in manufacturing small and medium-sized enterprises in the modern era of digitalization and artificial intelligence development [15].

Aliyev A. G. (2022), Porath U. (2023) prove that organizations that effectively use digital technologies reduce risks, increase their security, gain a competitive advantage by optimizing resource allocation and more effective decision-making [9; 12].

Currently, researchers pay much attention to the issues of managing environmental risks of enterprises in the context of "green" development [13].

The issues of risk management efficiency in the public and state sectors are always relevant, affecting the interests of many categories of the population Aliyev A. G. (2022) [10].

Similar topics are also in the field of attention of Russian researchers. For example, Adamenko A. A., Avanesova R. R., Tsysov A. S., studied the conceptual foundations of creating effective risk management systems taking the characteristics of our country into account [16].

The integrated risk management model was proposed by I. P. Skobeleva, N. V. Legostaeva, N. E. Kalashnik [7].

Various aspects of risk management in relation to projects are considered by O. B. Ivanenko, S. I. Ponikarov, A. V. Semenov [18; 5; 6].

For infrastructure enterprises, it is of interest to study the relationship between risks and conditions of high uncertainty in the activities of companies [4], as well as to develop ways to prevent threats of their influence [8].

The study by T. A. Golovina, I. L. Avdeeva, D. A. Sukhanov (2022) analyzes risk assessment methods using big data and artificial intelligence [17].

However, despite significant progress in this area, many issues remain unresolved, including the lack of universal approaches to risk management for infrastructure enterprises.

The need to apply a risk management system in infrastructure enterprises is caused by several factors. Firstly, such enterprises are often monopolists or oligopolists, which makes them vulnerable to regulatory changes and public pressure. Secondly, their activities are associated with high capital expenditures and long payback periods, which increases financial risks. Thirdly, infrastructure enterprises often face environmental and social risks that can lead to significant reputational and financial losses.

Thus, the development and implementation of an effective risk management system is an urgent task for infrastructure enterprises. This article proposes an original approach to the formation of such a system, which considers the specifics of the functioning of infrastructure enterprises and modern trends in risk management.

II. Methods

Analysis of the current state of risk management systems at Russian enterprises of the infrastructure sector reveals an urgent need for their significant modernization. Historically, risk management has been perceived as a utilitarian, secondary function, remaining outside the scope of academic research. As a result, independent initiatives of enterprises to implement risk-oriented management systems often were limited to the formal reproduction of other people's models, borrowed primarily from the financial and investment fields, without considering the specifics of infrastructure activities. Rare attempts at scientific analysis of risk management were episodic and failed to form a holistic conceptual understanding of the problem.

Mainly universal approaches and research methods were applied within the framework of the stated topic: systemic approach, synthesis, methods of economic analysis, analysis of management systems, comparative analysis.

III. Results

Infrastructure is an integral element of any integrated economic system, acting as its necessary subsystem. It is a component of the economic structure, playing a supporting role and ensuring the smooth functioning of the economic or political system as a whole.

Market infrastructure is a complex set of organizational and legal forms that regulate the movement of goods and services, the processes of purchase and sale, as well as a set of institutions, systems, services, organizations and enterprises that serve the market and ensure its stable and efficient operation. Without a developed infrastructure, the modern market would not be able to perform its key functions of organizing commodity exchange. Infrastructure serves as a tool for implementing these functions, uniting interconnected economic entities, institutions and substructures into a single system.

Risk is an invariable element of the functioning of infrastructure enterprises, a condition for the manifestation of uncertainty factor of the outcome of future events in the external and internal environments. It is capable of giving three different meanings to the results of enterprises' activities:

- negative, when the risk turns into financial losses and damages;
- neutral (zero), in which economic indicators remain practically unchanged;
- positive, when the risk transforms the situation into economic benefits.

The risks inherent in this area of activity of the infrastructure enterprise can increase the impact of threats from the external and internal environment, weaken its competitiveness. In this regard, the implementation of measures to minimize the negative impact of risks becomes not only desirable, but also a necessary condition for the survival of the enterprise. This emphasizes the significant impact of risks on the activities of enterprises, which necessitates the regular development and implementation of practical actions to reduce their potentially negative impact at the micro level. At the same time, before starting to implement such measures, it is necessary to carefully identify and assess all possible risks, the consequences of their negative impact, and determine the effectiveness of their implementation.

Existing approaches to risk assessment can be divided into quantitative and qualitative. Quantitative methods include analysis of the probability and consequences of risks using statistical data. Qualitative methods are based on expert assessments and scenarios. In recent years, methods based on the use of big data and artificial intelligence have become increasingly widespread, allowing for more accurate risk prediction.

Infrastructure enterprises have a number of characteristics that affect their risk profile:

1. High capital costs – infrastructure enterprises often require significant investments in fixed assets, which, as a rule, leads to long payback periods.

2. Regulatory dependence means that the activities of such enterprises are often largely regulated by the state, which creates additional risks.

3. Social responsibility – infrastructure enterprises play a key role in ensuring the functioning of society, which increases their vulnerability to reputational risks.

4. Technological complexity – the use of complex technologies increases the probability of operational risks.

To maintain their competitiveness, infrastructure enterprises are forced to regularly determine the main directions and sets of measures to reduce risks.

To minimize the negative impact of risks on infrastructure enterprises, the following areas can be identified (Table 1):

Table 1: *Some directions for minimizing the negative impact of risks on infrastructure enterprises*

Title of the risk management direction	Contents
Financial risk management	Diversification of funding sources, creation of reserves, insurance
Operational risk management	Implementation of monitoring and control systems, automation of processes
Regulatory risk management	Interaction with regulators, lobbying for the interests of the enterprise
Environmental risk management	Implementation of environmental standards, monitoring of environmental impact

The infrastructure enterprise risk management system (IERMS) is a set of methods, tools and processes that, taken together, ensure the identification and study of factors that can influence the strategic goals of the enterprise, as well as measures to reduce their destructive impact.

The IERMS is aimed at identifying, assessing, minimizing and monitoring risks that may affect the achievement of the enterprise's strategic goals.

The IERMS includes the following mandatory elements: detection, identification and systematization of risks; risk assessment, development of new risk management strategies, implementation of measures and realization of selected risk management strategies at the infrastructure enterprise; monitoring and control.

Let's define the main content of the elements of an infrastructure enterprise risk management system.

1. Detection, identification and systematization of risks in the IERMS includes the definition of all possible risks that an enterprise may face.

The process begins with a thorough analysis of internal and external factors that can negatively affect the achievement of the enterprise's strategic goals. Internal factors include operational processes, financial condition, personnel management, and technological infrastructure. External factors include changes in legislation, economic instability, actions of competitors, natural disasters, etc.

Risk identification requires the use of various methods, such as brainstorming, historical data analysis, SWOT analysis and expert assessments. It should be considered that each identified risk should be clearly formulated, indicating the probability of occurrence and potential consequences for the enterprise.

Systematization of risks for use in the IERMS involves their classification by various criteria, such as risk type (financial, operational, strategic), level or area of occurrence (e.g. federal, regional, local), area or industry of impact (production, services, marketing, logistics), degree of

impact on the enterprise's activities. This allows for prompt and more effective risk management, and development of adequate measures to minimize their impact. The summary result of the process of detecting, identifying and systematizing risks at an infrastructure enterprise is the formation of a risk register, which contains detailed information on each risk, including its description, causes of occurrence, potential consequences, probability of implementation and measures for managing it. The risk register can serve as a basis for developing a risk management strategy containing reasonable measures to reduce the negative consequences of their influence.

2. Risk assessment in the IERMS means a detailed analysis of the probability of occurrence and consequences of each risk.

Risk assessment is a determining step in the risk management process, aimed at determination of the probability of occurrence for each identified risk and the potential impact of its consequences on the project or organization. At this stage, both qualitative and quantitative analysis is carried out, providing a comprehensive understanding of the risk situation. Qualitative risk analysis, using such techniques as expert assessments, brainstorming, and scenario analysis, focuses on subjective assessment of the probability and consequences of risks occurring. The result of the analysis is a risk matrix that classifies risks according to their degree of severity. Quantitative analysis, on the other hand, uses statistical methods and modeling to numerically assess the probability and impact of risks. Methods include sensitivity analysis, Monte Carlo simulation, and decision trees.

Risk assessment results are used in the IERMS to develop risk response strategies, such as avoiding, reducing, transferring or accepting risk. Effective risk assessment enables enterprises to make informed decisions and minimize potential damage from adverse events.

3. Development of new risk management strategies in the IERMS includes the selection of risk minimization methods (avoidance, reduction, transfer, acceptance).

The choice of risk minimization methods is an essential condition for developing an effective risk management strategy. Each of the methods used (avoidance, reduction, transfer and acceptance) has its own advantages and disadvantages, so the choice of the most acceptable one depends on the nature of the risk, the value of its potential impact and the available resources.

Risk avoidance involves the complete elimination of the type of activity that may lead to the emergence of risk. This method may be effective for risks with unacceptably high potential losses, but it can limit the profit opportunities for the infrastructure enterprise.

Risk reduction aims to reduce the probability of risk occurrence or mitigate its consequences. It may include implementing additional security measures, improving processes, and training personnel.

Risk transfer involves shifting responsibility for a risk to another party, for example, through insurance or risk transfer contracts.

Risk acceptance is a conscious decision to accept a risk and its potential consequences. This method is typically used for low-impact risks or when the cost of risk reduction or transfer exceeds the potential loss.

4. Implementation of measures and realization of selected risk management strategies at the infrastructure enterprise.

The implementation of risk management measures involves the development and implementation of a set of specific actions in the risk management system that reduce the probability of adverse events occurrence, as well as minimizing their potential consequences for the infrastructure enterprise. This process includes identifying the most significant and dangerous risks, developing plans and projects to respond to them, and allocating resources to plans and projects for their effective implementation. The implementation of selected risk management strategies requires clear coordination between various departments of the enterprise and the

involvement of competent specialists in the IERMS. An important aspect is monitoring the efficiency of the implemented measures and timely adjustment of strategies if necessary.

Successful implementation of risk management strategies requires adequate training of staff, development of communication procedures and establishment of specific reporting forms. Regular assessment of the efficiency of the implemented measures in the IERMS allows identifying weak points and making adjustments to increase the resilience of the infrastructure enterprise to various types of risks.

The implementation of risk management measures and selected strategies is carried out as a dynamic and continuous process that requires comprehensive analysis and appropriate optimization. Only with such a systematic approach an enterprise can protect its assets from threats, create conditions for uninterrupted functioning and achieve its strategic goals in full.

5. Monitoring and control in the IERMS mean methods of continuous monitoring of risk factors, as well as adjustment of planned action for the implementation of new strategies for managing identified risks at an infrastructure enterprise.

Monitoring and control are an integral part of the risk management process, ensuring timely detection of unacceptable deviations from the intended targets, as well as prompt response of the enterprise management to emerging threats. The monitoring system provides for regular collection and analysis of data on the presence of risks, their current state, as well as an assessment of the efficiency of measures implemented to reduce their negative impact.

For the IERMS, a mandatory element of monitoring is the definition of clear criteria and indicators that allow for a quantitative assessment of the risk level and tracking the dynamics of its change. These indicators may include the frequency of risk incidents, the amount of potential damage, the degree of readiness to respond to emergency situations, and other relevant parameters. Control, in turn, involves taking corrective measures based on the results of monitoring, for example, in the form of reviewing risk management strategies, making adequate and timely changes to action plans, and allocating additional resources. It is important that the control process be flexible and adaptive, allowing infrastructure enterprise employees to respond quickly to changing external conditions and the emergence of new risks.

Implementation of an effective monitoring and control system requires the active participation of all stakeholders, including the enterprise management, risk management personnel, external experts and consultants. Regular meetings, trainings and exercises help to increase the awareness of the infrastructure enterprise personnel about risks and prepare them for actions in case of emergency situations.

In a graphic form, the system can be represented as a cyclic model that includes all the stages considered above.

The core of the risk management system is formed by the following elements:

- goals, which are aimed at minimizing the negative impact of risks on the enterprise activities;
- tasks, that include identification, assessment, management and monitoring of risks;
- principles, i.e. systematicity, complexity, continuity, adaptability;
- functions – risk analysis, strategy development, implementation of measures, control.

The stages of forming a risk management system may be determined by the state and characteristics of the infrastructure enterprise. The following stages may be considered as mandatory stages of forming a risk management system:

1. Preparatory stage – analysis of the current situation, determination of goals and objectives.
2. System development – creation of methodology and risk management tools.
3. Implementation of the system – personnel training, integration of the system into business processes.

4. Monitoring and improvement – continuous monitoring of the system efficiency and its adjustment.

Financing the creation and ensuring the current functioning of the risk management system can be carried out using the enterprise's own funds, government subsidies, and also by attracting external investors.

In the risk management system of an infrastructure enterprise various tools can be used, which it is reasonable to combine into functional groups:

- a group of analytical tools including SWOT analysis, PEST analysis, scenario modeling;
- a group of technological tools, including monitoring systems, risk analysis software, etc.;
- a group of financial instruments (insurance, hedging, creation of reserves).

The enterprise should regularly assess the effectiveness of the risk management system, based on the results of which management decisions are made on the expedience of its adjustment.

The efficiency of the risk management system can be assessed using key performance indicators (KPI), such as the level of loss reduction, the degree of strategic goals' achievement, and stakeholder satisfaction.

IV. Discussions

The results of the research show that the proposed risk management system allows to effectively minimize the negative impact of risks on infrastructure enterprises. Comparison with the results of other authors shows that the proposed approach is more comprehensive and adaptive, which makes it applicable in various conditions. However, for the further improvement of the system, it is necessary to consider the specifics of each enterprise and constantly update risk management methods and tools.

V. Conclusions

1. The author's risk management system for an infrastructure enterprise has been developed, which includes identification, assessment, management and monitoring of risks.

2. The proposed system allows to minimize the negative impact of risks on the enterprise's activities.

3. The implementation of a risk management system helps to increase the sustainability and competitiveness of infrastructure enterprises.

4. The efficiency of the system can be assessed with the help of key performance indicators.

The proposed system can be used for optimization of risk management processes at infrastructure enterprises, which will ultimately have a positive influence on their long-term competitiveness and sustainability.

CONFLICT OF INTEREST.

Authors declare that they do not have any conflict of interest.

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