Assessed Probability of Risks in Dependence on Innovative Project Description

A. D. Kornilova, N. V. Shekhova, N. N. Belanova and E. V. Savoskina

Abstract Development and implementation of the innovation project involve significant risks, which require taking measures to assess the probability of risks and identify possible losses. In this work, the systematization and risk assessment of innovation activity were carried out using the example of organizations of the Russian Federation. In the course of this study, the authors revealed that the greatest risks are associated with the non-return of borrowed funds (75.28%), lack of external investment (71.99%), operational (technical) problems (76.03%), and failure to sell the product or technology of the innovation project (71.59%). All these threats are inherent in basic risks of the innovation project. Among the specific risks can be identified the risk of conservation—78.02%, and the risk of imitation of competitors by the company's patented innovations, copying of the innovation project—62.03%. Calculation of average risk values shows that, depending on the nature of innovation activity, the level of the probability of risks undergoes significant changes. So, for example, the greatest changes in values are peculiar to specific risks (72.63–39.39%). The smallest dynamics of average values is typical for risks securing property rights (55.7–62.66%). According to the results of calculations, the authors proposed measures for risk reduction with the greatest probability. In addition to traditional methods (hedging, limitation, insurance, etc.), it is advisable to use special measures such as protection of information on innovations, staff development, external consulting, verification of prospective partners for innovation, and improvement of quality management systems.

A. D. Kornilova (✉) · N. N. Belanova
Samara State University of Economics, Samara, Russia
e-mail: adkornilova@yandex.ru

N. N. Belanova
e-mail: Belanova.nata@yandex.ru

N. V. Shekhova · E. V. Savoskina
Samara State Technical University, Samara, Russia
e-mail: nataly65vf@gmail.com

E. V. Savoskina
e-mail: savoskina@mail.ru

S. Ashmarina and M. Vochozka (eds.), *Sustainable Growth and Development of Economic Systems*, Contributions to Economics,
https://doi.org/10.1007/978-3-030-11754-2_8

1 Introduction

In modern conditions, the performance of the organization depends on many factors, but the indispensable condition is its innovation activity, which allows providing competitive advantages and taking a competitive market position. Innovation activity entails high risks, which is the loss of resources or inadequate income and the appearance of additional costs in comparison with the planned option. Innovation risks have an objective basis due to the instability of the external environment and the uncertainty of its impact on the innovation process and its results.

The analysis of the views of economists on this issue shows that the major contribution to the study of modernization and innovative development was made by Asaul (2010), Chirkunova et al. (2016), Qazi et al. (2016), and Subbotin et al. (2017). Successful implementation of the innovation project involves timely identification and risk management.

Risk assessment and analysis are based on a well-developed risk classification. The active research in the field of risk classification was carried out by Karzhaev (2003), Kulikova (2008), and Golichenko (2015). Risk assessment and analysis are an important stage in risk management. There are quantitative and qualitative methods of risk assessment. Qualitative methods include the method of expert assessments, the method of rating assessments, etc. Quantitative methods include the method of adjusting the discount rate, the scenario method, the decision tree, the probability analysis of distributions, the Monte Carlo method, etc. Risk assessment and calculation of innovation are in the works of Artemenko (2002), Pribytkova (2005), Pomuleva (2012), Rudnik and Deptula (2015), and Farooq et al. (2018). In general, it can be noted that in the works of Russian economists, insufficient attention is paid to risk assessment of innovation activity. This is mainly compensated by using foreign forecasting and assessment methods. Difficulties arise due to the need to identify and justify the factors affecting innovation risk, rank them according to the degree of significance, as well as a large number of indicators that need to be quantified and estimated, which often requires the involvement of expert groups and can lead to a subjective nature of research. The above-mentioned provisions stipulate the need to improve risk assessment and analysis of innovation activity.

The goal of the study is to assess risks of the investment project. Proceeding from the goal, it is supposed to solve the following tasks:

- Identify the features and elements of the innovation project, implement the systematization of investment projects based on various criteria; consider the main stages of the innovation project development and the direction of innovation activity;
- Identify and systematize innovation risks, assess the probability of each type of risk and the entire set of investment risks for the investment project.
- Assess risks of the innovation project and develop methods for reducing these risks.

2 Materials and Methods

The methodological basis of the research is the system approach, which allows considering innovation activity as a holistic object, including a multitude of elements (from the innovation problem to the optimal version of the innovation project implementation and risk factors assessment).

This contribution is based on the methodology for calculating risks, developed by the Investment and Financial Group and the Russian Financial Corporation. The tasks to be performed in the course of quantitative risk analysis are: compilation of the exhaustive list of risks; determination of the weight of each simple risk in their entirety; probability of events applied to each simple risk; and determination of scoring for all project risks.

Thus, the following research methods were used in the work: formal-logical (deduction, induction, justification, and argumentation); abstract-logical (when setting goals, research tasks, and justifying a working hypothesis); empirical (observation and experimentation); economic-statistical (identifying risks in innovation and assessing the level of their impact on the innovative product), economic and mathematical. Data processing was performed using the Microsoft Office software package (Excel, Word).

3 Results

The project is a set of interrelated activities aimed at creating unique products or services in terms of time and resource constraints. Innovation projects have a number of features, which include:

- a sign of changes is the main content of the project;
- a sign of limited time;
- a sign of limited resources;
- a sign of novelty and uniqueness of the project;
- a sign of the complex influence of direct and indirect factors affecting the process and results of the project;
- a sign of the specific organizational structure for the period of project implementation;
- a sign of differentiated projects of the enterprise.

Depending on the types of innovation projects, a large number of interested parties (stakeholders) may participate in their implementations, which form the environment of the project. In the professional literature, various types are presented, and however traditionally, they are divided into internal and external, or near and far. Classification of main types of innovation projects can be based on several criteria (Table 1).

Table 1 Classification of innovation projects

Classification criteria	Types of innovation projects	Features of innovation projects
By the level of scientific and technical significance	Modernized	The prototype or the basic technology does not change radically
	Innovative	The new product differs from the previous one (new qualities are added)
	Advanced	The product is based on advanced technical solutions that have never been used before
	Pioneer	New materials, structures, and technologies are used that perform the old and new functions
By the scale of tasks to be solved	Mono-projects	Performed by one organization or even one department; differ in the setting of the unambiguous innovative goal, implemented in a strict time and financial framework, a coordinator or project manager is required
	Multi-projects	Combine a multitude of mono-projects (several dozen) aimed at achieving a complex innovative goal; require a coordinating unit
	Mega-projects	Multi-purpose integrated programs that combine a number of multi-projects and hundreds of mono-projects linked together by one tree of goals; require centralized funding and guidance from the coordination center
By duration	Short term	1–2 years
	Medium term	Up to 5 years
	Long term	More than 5 years
By the type of innovation	Creation of a new product	Different types of innovations are implemented depending on the stage of the life cycle in projects, they are aimed at achieving specific goals, and various methods of managing them are applied
	Creation of new technologies	
	Access to new markets	
	Connection to new sources of raw materials	
	Development of a new management structure	
By the type of innovation activity	Research	Innovation projects cover all stages of innovation activity associated with the transformation of scientific and technical ideas into a new or improved product
	Scientific and technical	
	Production update	
	System update	

Source Authors, compiled on the basis of works by Kornilova (2016), Chirkunova (2017), Korol (2017), Dmitrienko (2017)

The formation of innovation projects is to solve the most important problems that ensure a comprehensive system approach to the solution of scientific and technical problems, continuous management processes of creating, developing, producing and implementing innovations, justifying the selection of the most effective ways to achieve the project goals, balancing the resources necessary to implement the innovation project and effective management of a complex set of project activities.

The process of implementing targeted changes in accordance with previously developed rules, methods, and algorithms is the content of project management. An innovation project is a complex multifunctional dynamic object, and therefore, the management system must be flexible and capable of allowing adaptation to changes. In this connection, innovation project management is understood as the process of making and implementing management decisions related to specific goals, organizational structure, planning and monitoring of activities aimed at implementing an innovative idea.

In the generalized form, the management cycle is represented by two stages. In general, the process of managing the content and implementation of the innovation project can be presented in Fig. 1.

The innovation project is a variety of investment projects and has a number of distinctive features. Innovation projects are lengthier in terms of time, are highly

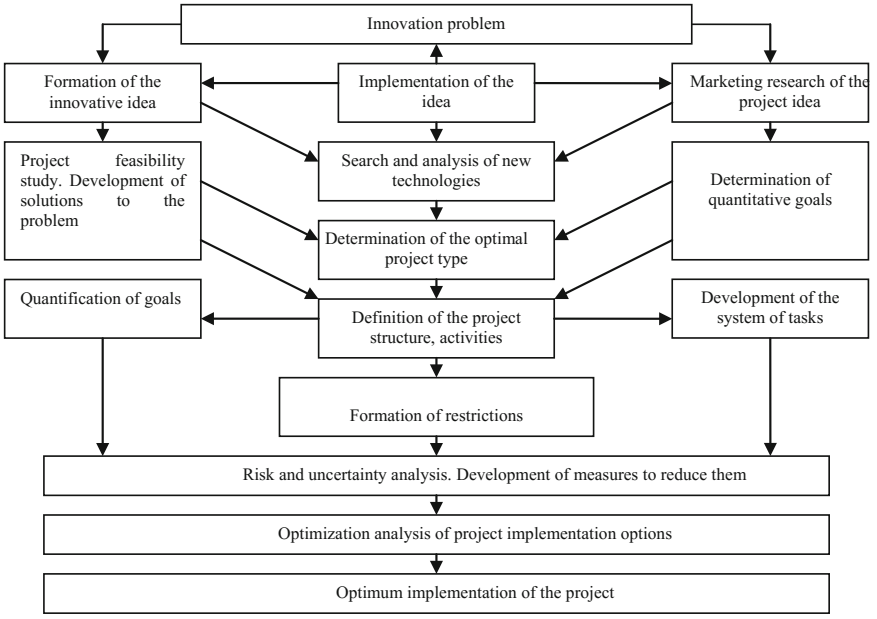

Fig. 1 Contents and main stages of the innovation project development. *Source* Authors, compiled in accordance with Russian State Standard GOST R 54869-2011 "Project management. Requirements for project management" (GOST R 54869-2011 2018)

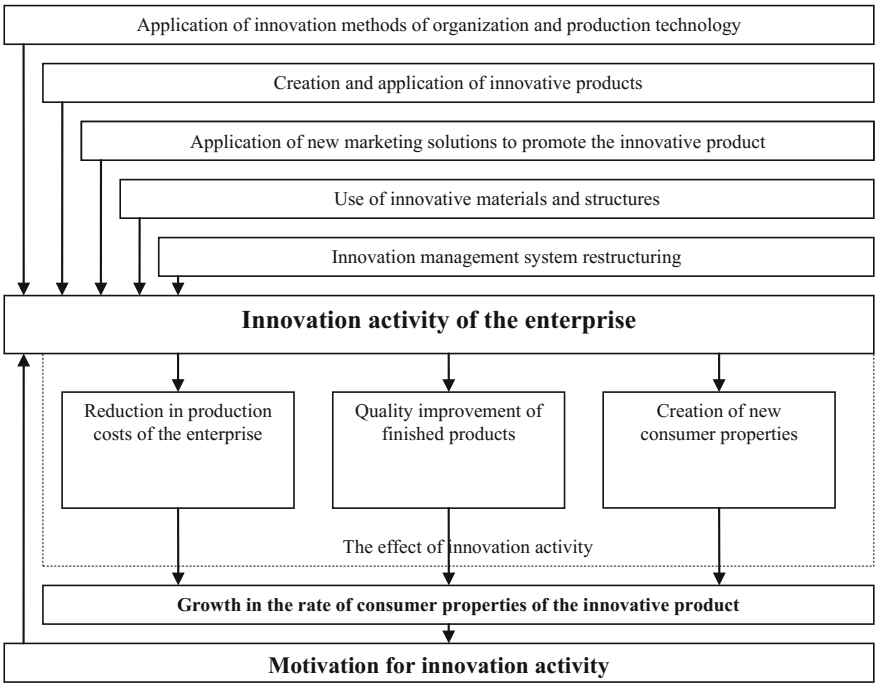

Fig. 2 Directions of innovation. *Source* Authors

uncertain and predictable by a number of parameters, and accordingly, are of a risky nature. This justifies the need for their thorough examination and assessment when planning the financing (Kornilova 2016).

The directions of innovation activity in construction can be presented in the form of a scheme (Fig. 2).

Difficulties in project decision making are due, first, to a significant degree of uncertainty about the future conditions in which the project will be implemented, and secondly, to the possible inconsistency of comparative assessments of alternative project options. The uncertainty factor of future project conditions leads to risks for investors and the need to take measures to reduce them (Belanova 2016).

At its core, the innovation risk is an economic category that depends on political, social, economic, environmental, technological situations and is an estimated quantity, the quantitative estimate of which may be the probability of the unfavorable outcome when investing in the production of new goods and services, in the development of new technology that may not find the expected demand in the market, as well as investing in the development of managerial innovations that will not bring the expected effect.

The innovation risk should be understood as an estimated probability (loss) of at least a portion of its resources, a loss of planned revenues (profits) from the innovation project, the value of a portfolio of financial assets, or the emergence of additional costs (Chirkunova 2017).

The innovation risk of the company implementing the innovation project is manageable. Risk management associated with the introduction and promotion of innovation is difficult, taking into account a high proportion of uncertainty. However, risk management tools can provide an analysis of innovation risks and their systematization (Table 2).

To assess uncertainty and risks, the following methods are recommended:

- verification of sustainability, which involves the scenario development to implement the project (pessimistic, most likely and optimistic) and calculate the break-even point;
- adjustment of project indicators and economic standards, replacement of their projected values with expected ones;
- formalized description of uncertainty using a logical scale or scoring system.

Most risk assessment tools are based on a scoring system: The expert places a certain number of points for each of the risk groups or for each risk in a separate group, and then, the risks are weighed and an overall risk assessment of the project is displayed. Based on this assessment, a conclusion is made about the project risk group and whether to finance it. The project risk assessment must necessarily be reflected in project calculations: All indicators should be determined taking into account the risk adjustment.

Research of risks in innovation activity and assessment of its impact on the amount of capital investment of the customer-builder when creating the innovative product was carried out on the basis of the criteria ranking methodology. The choice of this approach is based on the principle of exclusion and is determined by the properties of the object for risk assessment of R&D (Kudryashova 2014). The research involved research institutes (scientific research institutes), which occupy a certain niche in the scientific sphere. The specific gravity of each risk was determined on the basis of its ranking according to the nature of innovation activity (Table 3) (research (RE), scientific and technical (ST), production update (PU), system update (SU) in linking the duration of their implementation:

- Short-term—duration 1–2 years;
- Medium-term—duration up to 5 years;
- Long-term—duration more than 5 years.

To analyze the probability, the scale of risks is taken into account: P1 is a pessimistic option; L2 is the most likely option; O3 is an optimistic option. Each option was calculated by the formula 1 of the total probability:

Table 2 Systematization of risks

Types of risks	Examples of risks
Main risks	Risk 1. Risk of failure to sell new products and technologies of the company due to insufficient material, technical and raw material's base; shortage of raw materials
	Risk 2. Business risks associated with the variability in production costs
	Risk 3. Marketing risks associated with the sale of a new product and the insolvency of the buyer, short payment or late payment.
	Risk 4. Risk of incorrect forecasting of the situation and wrong initial data
	Risk 5. Risk of non-return of borrowed funds
	Risk 6. Risk associated with the implementation of the innovation project
	Risk 7. Operational risk
	Risk 8. Risks of unforeseen costs and income loss
	Risk 9. Risk of enhanced competition
	Risk 10. Risk of non-return or insufficient level of external investment
Specific risks	Risk 11. Risk of wrong R&D direction
	Risk 12. Scientific and technical risk (incompleteness and inaccuracy of information on the dynamics of technical and economic indicators, parameters of new technology)
	Risk 13. Risk of a negative scientific result
	Risk 14. Incorrect risk assessment of prospects to carry out R&D and (or) ROC
	Risk 15. Risk of choosing the wrong innovation project
	Risk 16. Risk of low scientific qualification of the personnel
	Risk 17. Risk of non-certified new products and technologies
	Risk 18. Risk of conservation associated with the fact that the environment surrounding the company is constantly changing, while the risk of conservation can lead to disharmony between the company and the external environment
Risks to secure property rights	Risk 19. Risk of insufficient patenting of technical and marketing decisions of innovations
	Risk 20. Risk of protests against patents defending fundamental technical, design and marketing decisions
	Risk 21. Risk of legal and illegal imitation by competitors of the company's patented innovations

Source Russian State Standard GOST R 54869-2011 "Project management. Requirements for project management." (GOST R 54869-2011 2018)

Table 3 Probability of major risks

Name of risks	Probability of risks				Average probability (Cv)
	RE	ST	PU	SU	
Main risks					
Risk 1	83.7	91.37	75.46	35.83	71.59
Risk 2	82.47	75.28	62.29	34.25	63.57
Risk 3	86.28	76.12	53.45	37.2	63.26
Risk 4	70.16	60.39	59.25	56.02	61.45
Risk 5	93.16	84.15	63.67	60.14	75.28
Risk 6	89.26	70.25	67.46	35.19	65.54
Risk 7	87.63	79.16	84.23	53.1	76.03
Risk 8	91.32	81.75	53.91	38.41	66.34
Risk 9	3.37	14.27	81.14	71.9	42.67
Risk 10	86.46	73.27	59.02	69.24	71.99
Specific risks					
Risk 1	63.27	69.26	62.82	25.89	55.31
Risk 2	81.36	86.51	38.01	36.34	60.55
Risk 3	95.42	76.85	67.11	27.17	66.63
Risk 4	76.54	63.47	29.37	17.46	46.71
Risk 5	76.89	77.88	43.27	29.48	56.88
Risk 6	65.94	67.24	53.36	52.38	59.73
Risk 7	41.6	46.35	79.36	61.74	57.26
Risk 8	79.99	91.03	76.42	64.67	78.02
Risks to secure property rights of the innovation project					
Risk 1	52.57	54.19	55.55	58.29	55.15
Risk 2	56.34	62.87	57.21	57.95	58.59
Risk 3	58.18	49.95	69.37	71.73	62.30

Source Authors. (The calculation was based on data collected from the documents: Monitoring the effectiveness of innovation (http://www.rvc.ru/upload/iblock/596/RVC_ITMO_05.pdf); Scientific, technical and technological expertise of projects; Analysis of the Russian market (http://www.rvc.ru/upload/iblock/f44/RVC_project_expertise.pdf); National report on innovations in Russia 2016 (http://www.rvc.ru/upload/RVK_innovation_2016_v.pdf); Case study: Innovation management in Russian companies (http://www.rvc.ru/upload/iblock/0dd/Management_of_Innovations_in_Russian_Companies.pdf), and grouped for each of the risk groups)

$$V(A) = V(L1) \cdot V_{L1}(A) + V(L2) \cdot V_{L2}(A) + V(L3) \cdot V_{L3}(A) \quad (1)$$

The results are summarized in Table 3.

Obtained data on the probability of innovation risks during the project tell us about the prevalence of the probability of risks associated with the non-return of borrowed funds (75.28%) and/or short payment or insufficient level of external investment (71.99%); with a high probability that technical systems of the project will fail (76.03%); the failure to sell the product, the technology of the innovation

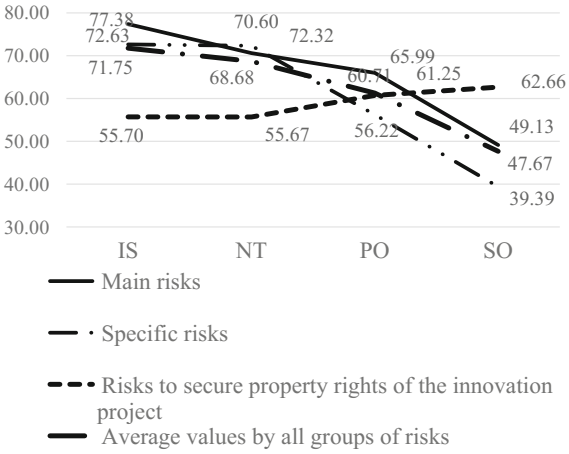

Fig. 3 Average values of risks by innovation activity. *Source* Authors. The data of average values for Table 3, grouped by types of risks and by all groups of risks in the context of innovation activity

project due insufficient material, technical and raw material's base, and the shortage of raw materials (71.59%). All these threats are inherent in the basic risks of the innovation project.

Among the specific risks can be identified the risk of conservation, due to the fact that the environment surrounding the company is constantly changing, which can lead to disharmony between the company and the external environment—78.02%. All research institutes also indicate a high probability of legal and illegal imitation by competitors of innovation patents, the copying of the innovation project—62.30%.

The calculation of average risk values by innovation activity (Fig. 3) shows that, depending on innovation activity, the level of the probability of risks undergoes significant changes. So, for example, the greatest changes in values are peculiar to specific risks from 72.63 to 39.39%.

The dynamics of average values for risks to secure property rights from 55.7 to 62.66%.

The graph clearly shows the dependence of the probability of risks on the innovation project (IP). The highest total values are inherent in research projects—77.38. About the risky event, there is nothing definite to say when implementing an IP in the framework of the system update.

The overall rate of a decline in the probability of innovation risks is the following:

- research risks in relation to scientific and technical decline by 9%;
- research risks in relation to the production update decline by 15%;
- research risks in relation to the system update decline by 37%.

Thus, it can be concluded that the greatest unpredictability is characteristic for research innovation projects, which implies from an economic point of view, a greater amount of financial loss to the economic entity and a decrease in the level of

profitability. Therefore, research IPs are attractive only in case of state support at all stages of innovation activity or use of public–private partnership mechanisms as incentives for such projects (Belanov 2014).

The resulting average risk values by innovation activity will allow developing financial, social, organizational and management tools and models depending on the type of innovation technology being introduced (Domnina et al. 2016).

Next, we will rank investment risks in terms of priority and determine the weights with which each simple risk is part of the company's overall risk that implements IP. We introduce the notation:

SRi simple risk, $i = 1,\ldots, n$;
n a total number of innovation risks ($n = 21$);
Gj a priority group, $j = 1$, p, $p < n$;
Wj a weight of simple risks by priority groups Gj, $Wj > 0$, $\Sigma Wj = 1.0$; Nj—a number of risks included in the priority group Gj

Twenty-one risks (Table 2) are grouped into four priority groups ($p = 4$) by the increase in the importance and influence of factors. Let us make the assumption that the first priority is four times more powerful than the fourth.

Sequence of calculations:

1. We will assess the priorities of risks, i.e., the importance of each individual event in the totality of risks. Then, the change in the percentage is determined by the change in the risk factor (Likhach and Savoskina 2015). It is important that such general requirements as nonnegativity of weighting coefficients and equating their sum to unity are observed.
   According to the authors' assumption, the first priority is four times more significant than the last one; that is, according to the formula: $W1/Wp = 4$.
2. The weight of the group with the lowest priority is made by formula 2.

$$\begin{aligned} Wp &= 2/[p(f+1)] \\ W4 &= 2/[4*(4+1)] = 0,1. \end{aligned} \tag{2}$$

The calculation of the weight values for the remaining three groups is determined by formula 3:

$$\begin{aligned} Wj &= Wk[(p-j)f+j-1]/(p-1) \\ W3 &= 0.1*[(4-3)*4+3-1]/(4-1) = 0.2; \\ W2 &= 0.1*[(4-2)*4+2-1]/(4-1) = 0.3; \\ W1 &= 0.1*[(4-1)*4+1-1]/(4-1) = 0.4. \end{aligned} \tag{3}$$

The weights of simple factors are determined by formula 4:

$$\begin{aligned} Wi &= Wj/M \\ W1 &= 0.4/6 = 0.067;\ W2 = 0.3/5 = 0.06; \\ W3 &= 0.2/5 = 0.04;\ W4 = 0.1/5 = 0.02 \end{aligned} \tag{4}$$

The results of calculations are summarized in Table 4, on the basis of which we determine the overall risk assessment.

The impact of the entire set of innovation risks is 66.09 points (high), the group for G1 and G4—66.09 points (the lower limit of high risk). Comparing with the five-level scale 0–100 points, the risk of the innovation project is estimated as possible (60–80 points), which means that the risk can be short term with a frequency of once a month (National Standard of the Russian Federation 2011). For example, comparing innovation and investment risks, we obtain the following comparison: 66.09 > 54.15 (Pribytkova 2005; Likhach and Savoskina 2015).

Table 4 Overall risk assessment of organizations

Priority group	Name of risks	*Wi*	Probability, *Cv*	Score, *Wi* Cv*
G1 = 0.4	Risk of conservation associated with the fact that the environment surrounding the company is constantly changing, and the risk of conservation can lead to disharmony between the company and the external environment	0.067	78.03	5.20
G1 = 0.4	Risk of non-return of borrowed funds	0.067	75.28	5.02
G1 = 0.4	Operational risk	0.067	76.03	5.07
G1 = 0.4	Risk of short payment or insufficient level of external investment	0.067	72.00	4.80
G1 = 0.4	Risk of legal and illegal imitation by competitors of the company's patented innovations	0.067	70.46	4.70
G1 = 0.4	Risk of the failure to sell new products and technologies of the company due to insufficient material, technical and raw materials' base, shortage of raw materials	0.067	71.59	4.77
G2 = 0.3	Risks of unforeseen costs and income loss	0.06	66.35	3.98
G2 = 0.3	Risk of the negative scientific result	0.06	66.64	4.00
G2 = 0.3	Risk associated with the implementation of the innovation project	0.06	65.54	3.93
G2 = 0.3	Business risks associated with variability in production costs	0.06	63.57	3.81
G2 = 0.3	Marketing risks associated with the sale of a new product and insolvency of the buyer, short payment or late payment	0.06	63.26	3.80

(continued)

Table 4 (continued)

Priority group	Name of risks	*Wi*	Probability, *Cv*	Score, *Wi* Cv*
G3 = 0.2	Risk of incorrect forecasting of a situation and wrong initial data	0.04	61.46	2.46
G3 = 0.2	Scientific and technical risk	0.04	60.56	2.42
G3 = 0.2	Risk of low scientific qualification of the personnel	0.04	59.73	2.39
G3 = 0.2	Risk of non-certified new products and technologies	0.04	57.26	2.29
G3 = 0.2	Risk of choosing the wrong innovation project	0.04	56.88	2.28
G4 = 0.1	Risk of insufficient patenting of technical and marketing decisions of innovations	55.15	0.020	1.10
G4 = 0.1	Risk of protests against patents defending fundamental technical, design and marketing decisions	58.59	0.020	1.17
G4 = 0.1	Risk of wrong R&D direction	55.58	0.020	1.11
G4 = 0.1	Incorrect risk assessment of prospects to carry out R&D and (or) ROC	46.71	0.020	0.93
G4 = 0.1	Risk of enhanced competition	42.67	0.020	0.85

Source Authors, the data of Table 3, processed on the basis of the methodology developed by the Investment and Financial Group and the Russian Financial Corporation

Thus, in the implementation of innovation activity, the organization forms a risk above the average level; the risk is likely to take place (Golichenko 2014). Therefore, the implementation of commercial innovation projects in the current micro- and macroeconomic situation in the country is not very effective, and it is necessary to adapt existing approaches to the formation of the structure of funding sources. In this case, a scenario-based approach to shape the structure of funding sources, taking into account risk reduction measures and the use of joint investment contracts, as well as the further development of forms of public–private partnerships (Savoskina and Burlakova 2017) is a highly effective method of constructing optimal schemes for financing innovation projects.

For each innovation project, based on risks that have a high probability, it is necessary to develop measures for their management (Lane et al. 2017; Belanova 2016). Traditional methods of risk reduction are:

– Diversification (allocation of investments for various innovation projects that are not related to each other): Based on the specifics of the implementation of each innovation project, industry (regional) specifics, the probability of risks for different projects will vary, but risks cannot be eliminated completely, as the influence of macro-environment factors can negatively affect the results of all innovation projects);

- Distribution of risks among participants of the innovation project (this increases the reliability of the innovation project, with the maximum responsibility for each type of risk to be transferred to the participant who is more in control of it);
- Limitation (determination of the maximum amounts of expenses, credit);
- Hedging (insurance of risks from unfavorable changes in prices for inventories under contracts and transactions in the future, taking into account probabilistic price changes and pursuing to reduce the negative consequences of their changes);
- Reserve for unforeseen expenses;
- Insurance, etc.

In addition to them, it is advisable to use special measures:

(1) Planning and forecasting of innovation activity;
(2) External consulting on legal, technical, and economic problems;
(3) Verification of prospective partners for innovation;
(4) Protection of information about innovations;
(5) Staff development in accordance with the needs of innovative solutions;
(6) Diagnostics of employees' readiness for innovative changes;
(7) Improvement of quality management systems.

The highest risks for the innovation project need to be analyzed in more detail. Consider the risks that have received the greatest score in analyzing and assessing risks of the innovation project (Table 5).

4 Discussion

Summing up the results of the conducted research, it can be said that the mathematical justification of the risk assessment on the one hand allows expanding the evidence base of calculations, on the other—gaining an additional opportunity to recheck and confirm the judgments made in the course of practical activity.

The practical significance of the research is to take into account and assess risks with regard to the innovation design, which allows them to be used in the practical work of relevant government bodies and commercial structures implementing innovation projects and working in the innovation field.

Obviously, the proposed procedure for the risk allocation, description and assessment requires a more comprehensive study of the possibility of risks, and the assessment of damage, but at this stage, it will allow further:

(1) Emphasizing and detailing a number of independent risk-forming factors in innovation activity that have a critical impact on the results of the innovation project;
(2) Assessing the probability and degree of threat of each of the factors with a more accurate definition of damage;

Table 5 Risk management

Types of risks	Reasons of risks	Methods of risk reduction
The risk of conservation associated with the fact that the environment surrounding the company is constantly changing, and the risk of conservation can lead to disharmony between the company and the outside environment	Errors in calculations Miscalculations in assessing the timing of the implementation Rapid aging of innovations Non-compliance with customer requirements Miscalculations in the development of the marketing concept	Research and consideration of macro- and microenvironmental factors of the organization Planning and forecasting of innovation activity Insurance Diversification
Risk of non-return of borrowed funds	Miscalculations in projected income-expenditure flows Deterioration of financial situation Change in macro-environment factors	Establishment of borrowing limits Insurance Diversification of the loan portfolio and risks
Operational risk	Miscalculations in assessing production opportunities Lack of technology Insufficient technical level Incompatibility with the technological structure	External consulting on technical problems Staff development in accordance with the needs of innovative solutions Improvement of quality management systems Distribution of risks between all participants of the innovation project
Risk of short payment or insufficient level of external investment	Insufficient return on invested capital High investment risks	Obtaining guarantees Developing profitable offers for investors
Risk of legal and illegal imitation by competitors of the company's patented innovations	Imperfect legislation Unfair behavior of competitors Lack of proper control by the organization	External counseling on legal issues Verification of prospective innovation partners Protection of information about innovations
The risk of the failure to sell new products and technologies of the company due to insufficient material, technical and raw materials' base; shortage of raw materials	Miscalculations in assessing necessary resources Unreliability of suppliers Excessive concentration of the enterprise on a limited choice of technologies Increase in prices for resources	Diversification of suppliers Provision of reserves Hedging

Source Authors

(3) Carrying out the analysis of the project results with a consistent change in critical factors;
(4) Choosing the optimal management option for each type of innovation risks: take, evade, reduce, and transfer.

5 Conclusions

Innovation activity involves significant risks. The analysis and evaluation of investment risks are based on rationale and systematization of risks. The authors of the study outlined the main types of innovation risks and divided them into three groups: the main risks, specific risks, and risks to secure property rights. The conducted research and risk assessment show that among the main risks, the operational risk, the risk of non-return of borrowed funds, the risk of the failure to sell new products and technologies, and the risk of insufficient investment are most likely to occur. Among the specific risks, the key is the risk of conservation; among the risks to secure property rights is the risk of imitation of innovations. In the contribution, the risk assessment is based on ranking according to innovation activity (research (RE), scientific and technical (ST), production update (PU), and system update (SU), in relation to the duration of implementation. The greatest unpredictability is characteristic for research innovation projects, which implies from the economic point of view, a greater amount of financial loss to the economic entity and a decrease in the level of the profitability.

The instability of environmental factors and uncertainty of their impact on design decisions lead to a high probability of risks and losses for investors, so it requires developing measures to reduce them. The contribution presents an integrated approach to risk management. The authors revealed the main causes of the probability of risks and suggested methods for reducing them.

References

Artemenko, V.B.: Integrated innovation risk assessment. Risk Manag. **1**, 5–20 (2002)
Asaul, A.N.: National strategy of innovative development. Econ. Revival Russia **1**(23), 4–8 (2010)
Belanova, N.N.: Problems of Innovative Development in Construction. Economic Aspects of the Construction Complex Management in Modern Conditions Samara, pp. 166–170 (2016)
Belanova, N.N.: The state and innovative development of the economy. Topical issues of economics and finance in the current challenges of the Russian and world economy. In: Materials of the II-th International Scientific and Practical Conference Kursk, pp. 392–396 (2014)
Chirkunova, E.K.: Diversification of the industrial complex as a factor in the innovative development of the territory. Econ. Manage. Prob. Solutions **6**, 4–9 (2017)

Chirkunova, E.K., Kireeva, E.E., Kornilova, A.D., Belanova, N.N.: Innovative development of the building complex on the basis of environmental and energy-efficient technologies. In: International Science Conference SPbWOSCE-2016 "SMART City", MATEC Web of Conferences 106, 08002 (2017)

Dmitrienko, A.V.: Classification of the innovation project parameters. Actual Prob. Econ. Manage. **3**(15), 28–33 (2017)

Domnina, S.V., Savoskina, E.V., Shekhova, N.V.: On innovative decisions in the investment-construction cycle. Procedia Eng. **153**, 741–746 (2016)

Farooq, M., Thaheem, M., Arshad, H.: Improving the risk quantification under behavioural tendencies: a tale of construction projects. Int. J. Project Manage. **3**, 414–428 (2018)

Golichenko, O.G.: National innovation system: from concept to methodology. Issues Econ. **7**, 35–50 (2014)

Golichenko, O.G.: The balance of externalities and internal effects in national innovation systems. In: Arkhipova M., Sirotin V., Dameri R.P., et al. (eds.) Proceedings of the 10th European Conference on Innovation and Entrepreneurship, pp. 223–230. University Of Genoa, Genoa (2015)

GOST R 54869-2011: Project management. Requirements for project management. URL: http://gostrf.com/normadata/1/4293797/4293797785.pdf. Accessed 30 April 2018

Karzhaev, A.T.: Innovative Venture Capital Risks and Management. Economics, Moscow (2003)

Kornilova, A.D.: Management of Regional Infrastructure to Stimulate Innovation. Actual Problems of Agrarian Science and Ways to Solve Them: A Collection of Scientific Papers Kinel, pp. 811–814 (2016)

Korol, S.P.: Innovative development of the construction industry as an economic category of the management object. Reg. Econ. Manage. Electron. Sci. J. **1** (2017). URL: http://eee-region.ru/article/4501/. Accessed 10 April 2018

Kudryashova, O.V.: Development of the Risk Management System for R&D at the Industrial Enterprise: Monograph (2014)

Kulikova, E.E.: Upravlenie riskami: innovatsionnyy aspekt (Risk Management: Innovation Aspect). Berator, Moscow (2008)

Lane, R., Bettini, Y., McCallum, T., Head, B.W.: The interaction of risk allocation and governance arrangements in innovative urban storm water and recycling projects. Landscape Urban Plann. **164**, 37–48 (2017)

Likhach, N.A., Savoskina, E.V.: Evaluation of the investment project efficiency taking into account the risk and uncertainty. Econ. Property Manage. **1**, 34–40 (2015)

National Standard of the Russian Federation Risk Management Standard: Risk Assessment Methods. GOST R/31010 — 2011 (ISO/IEC 31010:2009 Risk management—Risk assessment techniques (IDT). URL: www.sibfana.ru/files/ГОСТР20ИСО31010-2011_Методыоценкириска.pdf. Accessed 23 April 2018

Pomulev, A.A.: Risk Management of Small Business. LAPLAMBERT, Academic Publishing, Germany (2012)

Pribytkova, G.V.: Risk analysis and assessment at manufacturing enterprises in the process of investment design. Bull. Moscow State Tech. Univ. **8**(2), 300–305 (2005)

Qazi, A., Quigley, J., Dickson, A., et al.: Project Complexity and Risk Management (ProCRiM): towards modelling project complexity driven risk paths in construction projects. Int. J. Project Manage. **7**, 1183–1198 (2016)

Rudnik, K., Deptuła, A.: System with probabilistic fuzzy knowledge base and parametric inference operators in risk assessment of innovative projects. Expert Syst. Appl. **17–18**, 6365–6379 (2015)

Savoskina, E.V., Burlakova, O.D.: Measures of administrative impacts used in the process of implementing the investment project (based on the example of construction organizations in the Samara region). Bull. Univ. **4**, 141–147 (2017)

Subbotin, M., Bianchi, A., Bombarda, F.: Preliminary risks analysis of the IGNITOR Project realization phase. Fusion Eng. Des. **124**, 1246–1250 (2017)