Risk analysis of the modern anthropotechnical environment

A Mayakova

1 Southwest State University, 94 50 Iel Oktyabrya str., Kursk 305040 Russia

E-mail: berryannett@yandex.ru

Abstract. The science and practice offer risk management methodologies that are relevant to modern production, economic and socio-humanitarian realities. Risk management methodologies are successfully developed and implemented in Russia through the creation of scientific and professional communities. Their goal is to solve specific management tasks of identifying, analyzing, controlling, and predicting risks. Russian organizations operating internationally are the first to update foreign risk management methodologies for their managers, and now they are implementing a systematic corporate risk management approach. The world practice also offers standardization in risk management. Such a system successfully operates in the territory of the EU, which is represented by the International Organization for Standardization (ISO). The standards of this organization regulate not only the sphere of risk management, but also the quality management, auditing, production regulation, environmental management, and others. Most of the standards are adapted in the Russian context and are presented in the form of national standards GOST R. The paper considers risk analysis, one of the leading risk management methodologies both in Russia and abroad. We will draw analogies and differences with other modern approaches and risk management methodologies.

1. Introduction

Risk management is a specific management methodology that includes a set of management procedures and methods for solving problems of identification, analysis and evaluation, risk monitoring and information exchange related to risk. The purpose of this methodology is to reduce the costs of an organization and increase its profitability [1]. The risk management objectives cover a whole range of problems of persons and societies: human safety, health protection, environmental safety, certain consequences of financial and economic crises, and others. When considering a risk from the point of view of a particular organization, the task and problem takes the following shape. The problem of risk management is relevant and appropriate, especially in the current conditions of the residual financial and economic crisis and its consequences. Versatile and difficult to formulate risk management tasks involve in their decisions the use of an integrated systems approach, which is contained in the modern methodology of risk analysis [2].

2. Materials and Methods

In the context of this article, it is planned to consider the risk analysis methodology. This methodology is relevant and widely used both in Russia and in the countries of Western Europe. Moreover, the concept of risk analysis is developed precisely in the regulatory documents of the European Union. In this regard, it is advisable to define analogies and differences in approaches and methods of risk management in
Russia and abroad, as well as to argue the relevance and priority of risk analysis and its regulatory
documents in comparison with other methods and procedures of risk management.

3. Results

The global practice of applying risk analysis is focused not only on its use in a particular organization,
but also on the state level. Thus, the governments of the countries of the European Union have always
focused their attention on the safety of citizens, in particular on risks. But lately, risk management has
gradually occupied a central position in the activities of the state. As in Russia, in international and
European standards, the concept of risk is used to describe a variety of problems and threats. The
contemporary society is in constant development, which is accompanied by the constant presence of
risk in human life and society. This fact determines the global meaning of the problem of risk
management and justifies its relevance: reduction of external risks associated with various kinds of
security (health care, physical, and financial security), providing a free access to quality public services
[3].

At the same time, the fact that there is a risk at the state level (unforeseen political and economic
incidents, the threat of disruption of state programs and projects) will not be disputed. Such uncertainty
is not new. Characteristics of risk are subject to change for two main reason. First, the general rapid
development of science and technology at the moment is accompanied by constant technological risks
[4]. Second, interstate and domestic risks arise from the integration of the global economy, the creation
of common communication systems and the generation of common environmental problems. The close
interrelationships of the global infrastructure characterize systemic risks: adverse events occurring at
various points on the globe affect its inhabitants more than before. At the moment, such risks have a
reasonable priority over others. In this regard, the governments of many developed and developing
countries are focusing on improving the risk management methods used.

Recently, the situation of mass replication of international, including European standards, has been
observed; these standards regulate the procedure for managing risks of man-made factors [1, 5, 6, 7]. In
Russia, the document “Risk Management of Organizations. Integrated Model,” developed by the
Committee of Sponsoring Organizations of the Treadway Commission, received the biggest attention
[8]. The regulatory document reflects the conceptual framework and risk management methodology
within specific organizations and includes clear recommendations for creating an intra-organizational
risk management system. The risk management methodology of a COSO organization consists of eight
elements: the definition of the internal environment; setting goals and objectives; risk identification;
assessment of each risk; risk “response”; controls; information and communications; monitoring [9].

In this regard, the COSO regulatory document presents a risk management methodology from the
perspective of the process approach known in risk management and quality management [10]. Despite
the clear methodology of the presented document, Russian managers and specialists have adopted the
risk management standard of the Federation of European Risk Management Associations as the basis
for risk management methodology in Russia. One of the advantages of this standard over the COSO
document is the more acceptable terminology adopted in the documents of the International
Organization for Standardization [11]. The concept of “risk” is defined as “a combination of the
probability of an event and its consequences” [11]. Risk management is a central part of the
organization’s strategic management and includes not only a set of measures and procedures for
identifying and assessing risks, but also programs for monitoring and minimizing risks.

The risk analysis methodology is such a unified risk management system. The main standard of the
Russian Federation regulating the risk analysis methodology is the adapted standard GOST R 51901-2002
“Reliability Management. Risk analysis of technological systems” [1]. Many industrial enterprises
have introduced this methodology into their risk management activities; however, many still try to do
without it due to the complexity and systematic nature of its implementation. For example, the
complexity of implementing risk analysis in the service sector lies in the uncertainty of business
processes that must be documented in a risk analysis program.
Let us consider this methodology in more detail. The process of implementing a risk analysis is divided into two major subprocesses. The first is to identify and assess the scale of the risk to be analyzed and managed. This subprocess is called the stage of characterization of risk (nonconformity). The second subprocess involves a detailed risk assessment and the development of a set of measures to minimize and eliminate it. This subprocess is defined as the decision stage. However, the risk analysis process is cyclical and reversible; therefore, a return to the risk characterization stage is possible in the event of a new threat at the decision-making stage.

Risk identification is a meaningful procedure in the decision-making process for risk and strategic planning in general. In most cases, attention is focused on the process of risk analysis itself to the detriment of solving a global problem, an integrated approach to eliminating and minimizing risks on a large scale. Concentration on any one threat leads to the destruction of the entire risk management system. The solution to this problem should be comprehensive, opening the relationship of threats to each other. Only then risk management will be effective. Such a “slogan” underlies the risk analysis methodology.

According to the GOST R 51901-2002 “Reliability Management: Risk analysis of technological systems”, risk analysis is a structured process. The purpose of this process is to determine both the likelihood and the size of the adverse effects of the studied action, object, or system [11]. The feature of risk analysis is that this process is structured and contains clear rules for conducting. Moreover, risk analysis necessarily involves the compilation of a risk matrix, in which the interrelations of risks and their assessment are clearly traced. So, risk analysis is divided into the following steps:

1. Determining the scope (process, complex processes, the activities of the organization, region, country, etc.);
2. Risk identification (risk type), which is followed by a potential risk assessment (SWOT, FME (C) A analysis, FTA analysis, and others);
3. Qualitative / quantitative risk assessment (degree of risk influence; probability of risk occurrence);
4. Analysis of the impact of risk on a specific scope (process, complex processes, organization’s activities, region, country, etc.);
5. Development of a set of measures to minimize and reduce a risk;
6. Compilation and analysis of the risk matrix.

4. Discussion
According to many experts in the field of risk management (Neumann, G. K., Grace, P., Burns, D., Surridge, M.), “looping” only on critical risks is not the right solution [12]. The situation in all areas of risk must be stabilized through a policy of minimizing risk factors. Naturally, potential threats will remain, especially macroeconomic ones. However, the organization should conduct its activities based primarily on sound strategic planning, one of the components of which is risk analysis. At the same time, risk analysis is a complex procedure that must be carried out periodically. Otherwise, the efficiency and effectiveness of risk management in an organization will be close to zero. The frequency is set individually, depending on the number and characteristics of the risks identified during the first procedure.

5. Conclusion
In conclusion, it should be noted that the systematic integrated risk analysis within the framework of risk management in an organization provides the following opportunities:

1. Improving the organization’s strategic planning;
2. Modernization of decision-making policy, which is coupled with a set of specific measures to minimize and eliminate a risk;
3. Improving the organizations’ competitiveness in the market;
4. Revaluation of resources, more successful use of positive factors of organization;
5. Effective management of potential risks and inconsistencies;
6. Cost reduction in the production of products and services;
7. Flexibility and mobility in making decisions regarding the organization’s activities and the risks associated with it;
8. Development of the organization’s innovative activity.

The global practice of risk management is contained in the developed regulatory documents, which contain elements of risk management. The EU Risk Management Recommendations contain a general requirement, which is supported by the Russian Federation, of a detailed expert analysis. This expert analysis is carried out by the employees engaged in risk management activities both within the same organization and at the state and intergovernmental levels. Risk analysis supports this initiative. As can be seen from the risk analysis procedure, the whole methodology is based on the principle of expert analysis. Along with expert analysis, international standards for risk management are similar in the dynamics of this process, its systematicity and consistency, focus on strategic goals, transparency and meaningfulness. Consequently, effective risk management allows one not only to carry out daily activities more efficiently, but also to plan and make strategic decisions on important issues at various levels. Risk analysis within risk management is a documented process that enhances the traceability of decision making.

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