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Development of integrated risk management system at construction industry enterprises

The paper is devoted to the problem of identifying and taking into account the main features in the development of the risk management system in the construction industry. Such concepts as risk, risk classification, informatization, basic principles of developing a risk management system in the activities of enterprises, investment project and investment process are considered. The purpose of the paper is to study the features and methods of improving the efficiency of construction companies based on the development of a risk management system. The object of this paper is the construction industry and business in Russia. The subject of the study is the specifics of developing a risk management system for this area. The research methods are theoretical analysis and empirical research, in particular, the analysis of statistical data, as well as description and grouping of data. The information base for the study of this problem was literature sources on the activities of construction holdings under the influence of external and internal environmental factors on the process of developing their strategy of functioning and development, scientific papers, monographs, electronic resources, legal sources. Such scientific methods as description, comparison, classification served as the methodological basis for the paper.

Keywords: *management, construction business, enterprise, risk management, risk management strategies, implementation, big data*

INTRODUCTION

Nowadays, the construction industry is one of the leading sectors of the economy and it provides us not only with a sense of stability and confidence among the citizens of the state, but also creates the foundation for economic growth of a country. It is the construction sector that creates the conditions for the functioning of the whole market mechanism, which is the economic basis of the capitalist state and it also lays the groundwork for solving complex social problems. However, in modern Russia under conditions of macroeconomic crisis and geo-political turbulence associated with the fall in demand for property, by reducing solvency of the population, market volatility and the intensification of internal problems of organization financial management, previously profitable investment and construction projects can become increasingly loss-making that leads to the growth of the number of bankrupt construction companies and the transition of the construction industry to recession.

LITERATURE REVIEW

A great deal of studies have been devoted to the effective functioning of construction enterprises, problems of economic regulation of their development and identification of ways to improve their efficiency under risk conditions, namely: P.G. Grabovyy, G.M. Zagidullina, M.I. Kamenetsky, I.G. Lukmanova, B.B. Khrustalev, N.Yu. Yaskova and others. Many scientists tend to point out the risks caused by the action of objective (external to the company and unmanageable) and subjective factors.

MATERIALS AND METHODS

The methods (Fig.) of the study are theoretical analysis and empirical research in particular statistical data, immutability of the first two principles of risk

management can be considered a debatable issue due to the existence of objective risks that accompany the enterprise, regardless of the governing body decisions [1–3]. Analysis, as well as grouping of data.

The information base for the study of this problem was the literature (textbooks, study guides) on investment and innovation activities of enterprises under the influence of external and internal environment risk on the process of developing a risk management system, scientific papers, monographs, electronic resources, reference legal system “Consultant Plus”, legal sources.

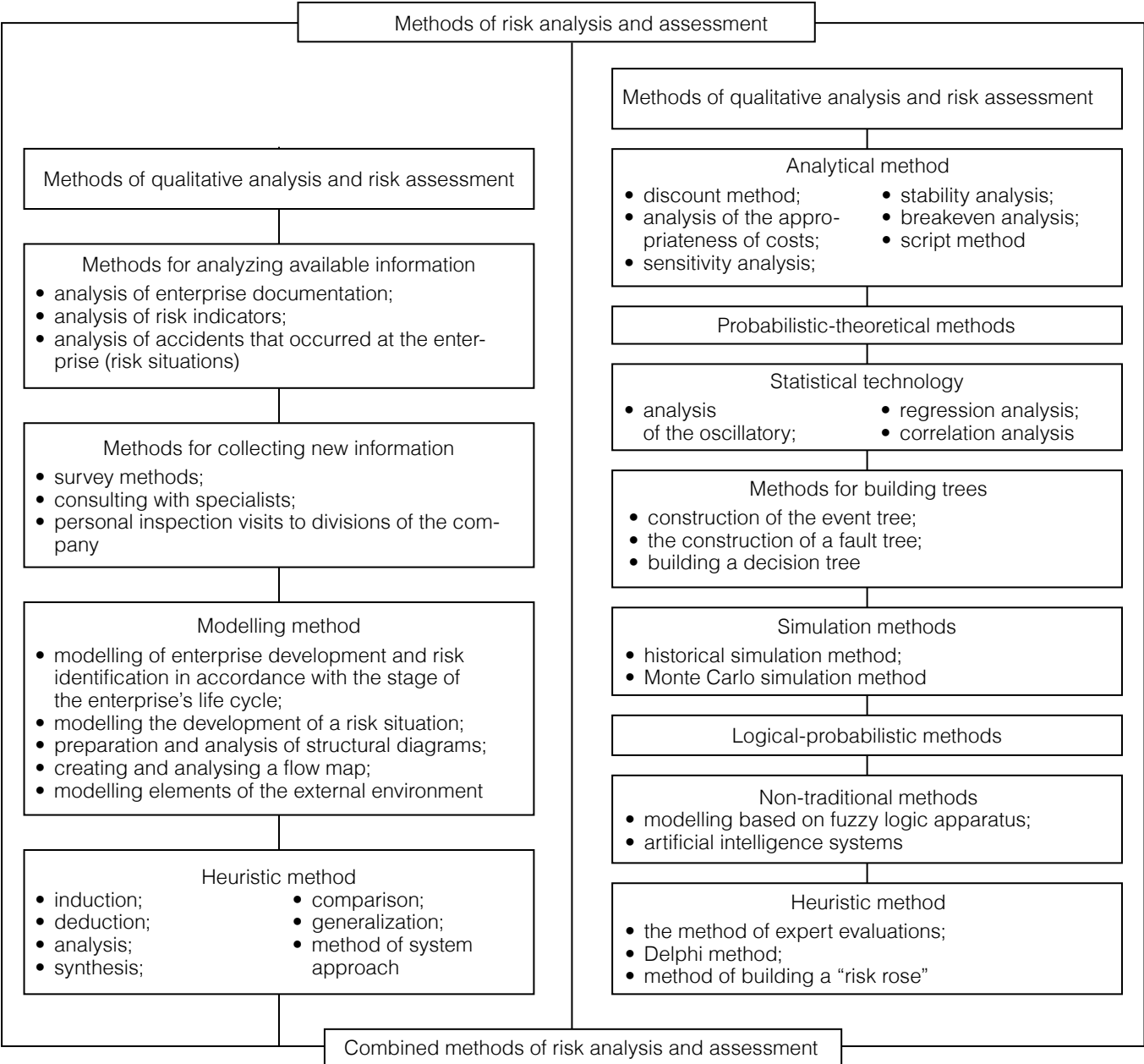
Scientific methods such as description, comparison and classification served as the methodological basis for the paper.

A comparative study of the economic literature of Russian and foreign authors allows us to classify existing methods of risk analysis and assessment into three mutually complementary groups: methods of qualitative, quantitative and combined analysis (Fig.).

Qualitative methods are mainly directed to carrying out a logical analysis of establishing the existence of various types of risks, their determining factors, reasons and possible consequences. There are four subgroups of methods for qualitative risk analysis:

- 1) methods for analyzing existing information;
- 2) methods for collecting new information;
- 3) modelling methods;
- 4) heuristic methods.

Methods for the available information analysis include, first of all, document analysis of financial, managerial, statistical, technical, etc. reports of the enterprise, as well as the analysis of the relative financial indicators of the enterprise and the analysis of the accidents that occurred at the enterprise (risk events). For example, by analyzing financial



Methods of risk analysis and assessment

reporting documents (the balance sheet, the reports of financial results (profit and loss), and other forms of accounting statement), one can identify all the existing property of the organization, its liabilities and debts and its exposure to risks. Based on the analysis of the relative financial indicators of the company (solvency, liquidity, stability, bankruptcy), it is possible to reliably predict possible risks, the degree of probability of their manifestation and possible losses from each risk. The analysis of the accidents (risk events) that occurred at the enterprise will contribute to the formation of standard procedure reserve for behavior in such situations and decision-making for their rapid elimination of adverse consequences of accidents (risk events).

Among the methods of collecting new information about potential risks in the company's activities there are mainly survey methods,

consulting with specialists, as well as personal inspection visits to the company divisions [4–6].

A survey is a collection of written information using standardized or specialized questionnaires that include a detailed list of questions that reflect the various fields of activity of the enterprise. The difference between these questionnaires is that standardized questionnaires contain a universal set of general questions and they can be used for most types of manufacturing, while specialized questionnaires are developed for specific activities taking into account their characteristics and the necessary detailing of particular provisions.

Consulting allows us to identify risks in a direct conversation with specialists working in the company, as well as with external ones who know and have an idea of the difficulties that arise in their work. This method allows us to assess the risks in the dynamics including the forecast for the future.

► In order to collect additional information and to verify its accuracy and completeness on places, personal inspection visits to the company divisions are conducted which allow not only to identify and clarify certain aspects of the risk management system but also to assess the possible costs of risk management in the given division, as well as to make recommendations on risk level regulation. Meanwhile, the inspection visit may be unexpected so that it is possible to note specially hidden facts or it may be with advance notification for the employees. In any case, when planning a visit, the list of tasks and problems that can be solved or clarified during a direct inspection visit is initially determined. Then the division visiting plan is formed based on a preliminary assessment of the tasks and taking into account various special factors and containing a logical scheme for identifying risks and allowing us not to miss anything significant.

Methods of modelling involve creating and researching of business process models and phenomena in order to predict the occurrence of possible risks. First of all, these methods include modelling of enterprise development and risk identification in accordance with the stage of the enterprise life cycle, modelling of risk situations, making and analyzing structural diagrams, analyzing flow maps and modelling the elements of the external environment.

Modelling the enterprise development and determining risks in accordance with the stage of the enterprise life cycle make it possible to predict and assess the risks inherent to enterprise development in a certain stage with a sufficiently high degree of probability. The given method also allows to develop a set of measures to influence risks taking into account the organizational and economic characteristics of the life cycle stage.

Modelling the development of a risk situation is based on the identification and the study of objective and subjective risk factors, individual groups or types of risk, as well as the consequences of each real or predicted risk. At the same time, risk factors can be identified in various ways: from complex probabilistic analysis in operation research models to purely intuitive suppositions.

The method of structural diagrams clearly demonstrates the various aspects of activity and the interrelation between structural and technological divisions of the enterprise and it is intended to identify, first of all, internal risks associated with the quality of management, marketing, organization of work, etc.

The analysis of the flow map, which is a useful addition to the method of structural diagrams, is aimed at identifying the main risk factors of the production process and an approximate assessment of the reliability and stability of the key elements of the manufacturing and technological processing chain.

Modelling elements of the external environment is necessary to identify risks emanating from the external environment, as well as to determine the degree of their homogeneity and stability.

Heuristic methods of qualitative risk analysis are based on logical rules and techniques generated by thinking and implemented on the basis of existing information, including the methods such as induction, deduction, analysis, synthesis, as well as the methods of comparison, generalization and system approach.

The induction method is a process of identifying the most likely patterns arising from the comparison of the initial individual statements and facts, providing the opportunity to make generalizing conclusions and formulate general provisions. In other words, induction is characterized by the knowledge of reality by moving from the particular to the general.

The method of deduction involves the study of reality by investigation from a general conclusion or proposition to single specific cases, statements and facts.

Analysis is a method of research that involves dividing the object, process, or phenomenon under consideration into separate parts and determining the characteristics, properties and qualities of an individual element.

Parts, attributes, properties and qualities that have been divided by analysis are combined by means of synthesis in order to identify common features, properties and qualities that link these parts into a single whole [7, 8].

The essence of the comparison method is identifying the qualitative and quantitative characteristics of an object, process or phenomenon and implementing on the basis of certain criteria for classification, ordering and assessment.

The generalization method is a procedure for establishment and fixation common properties, attributes and qualities of objects, processes or phenomena.

The method of the system approach provides for the study of a single object, process or phenomenon as a system consisting of a certain number of interrelated elements that interact with each other and affect the efficiency of the entire system as a whole.

RESULTS

Modern construction companies of Russia implement no more than three risk management tools and do not link them to the financial activities of the company. There is also no integration of risk management into the fundamental strategic orientation of the company. Only large construction corporations in Russia are engaged in systematic risk management. Small and medium-sized enterprises do not implement this system in management as they consider it economically unprofitable and unsound.

Implementation of risk management in the construction sector requires the commitment of the governing body and availability of certain conditions for the realization of the risk management programme. The "big data" system allows us to process large amounts of relevant information. It also contributes to the accuracy of risk assessment and thereby making the development of risk management is one of the most actual tasks using this system.

DISCUSSION

Construction is traditionally one of the leading economic sectors that play a fundamental role in the social and economic development of any country and set the prerequisites for ensuring social wellbeing and strategic economic stability.

Taking into account the given destructive prerequisites and features, we can state that the situation in Russia remains tense and the business prospects of the construction industry are uncertain. Under the pressure of destabilizing factors that weaken the "immunity" of national construction enterprises to the turbulence of the external environment, companies are turning to the search for the new methods and means of management. Risk management is one of these methods, the task of which can be recognized as the conservation of assets and profitability of the enterprises with the possible risk of significant losses.

The ultimate goal of risk management corresponds to obtaining the highest profit at the optimal ratio of profit and risk for the company's governing body. We can distinguish the main goals that can be set for the risk management system: revealing zones (areas) of high risk; risk assessment; eligibility analysis of the given risk level for the organization; development of measures to prevent or reduce risks; if the risk event occurs, measures should be taken to minimize or compensate for the damage.

The main element in the risk management process is the risk classification, which determines the place of risk and its factors in the overall risk system. The main group risks that are specific to the construction business are presented in Table.

Risk management is based on a range of principles. Thus, when making management decisions in this area of management, it is necessary to follow the given principles: awareness of risk taking, comparability of risks and prospective profitability level, comparability of the probability of threats and the size of associated losses for the enterprise, accounting of the time factor and the overall strategy of the enterprise development.

The principle of awareness implies that the manager taking such decisions must have sufficient substantiation for the implementation of an action involving risk. However, one should take into account the fact that although the evasion/avoidance of risk is an acceptable risk management method, it is impossible to eliminate the risk situations entirely out of the functional activities of

the organization because financial risk is an objective phenomenon affecting many economic operations of the enterprise.

The essence of the principle of comparability of risks and prospective profitability level is directly related to the principle of awareness since the search for the optimal ratio of profit and risk is fundamental in financial management. Therefore, the company can only assume those risks that are compensated by bonuses received as a result of the operation– in another case, the risk is unjustified [9]. However, the process of implementing and using the risk management system is associated with certain difficulties. The main barriers that prevent the most effective use of risk management tools in enterprise management include: insufficient development and effectiveness of the methods used to identify risks, incorrect assessments of threats and uncertainty factors; insufficient information support for risk management; poor quality of the information about risks; low level of communication policy in the company, not adequate enough, actual and complete exchange of information on risks between departments; underdevelopment of the corporate culture of risk

Classification of risk factors in construction industry [9]

Factors		Description
Exogenous	General economic	Changes in currency exchange rate, ruble devaluation, growth of tariffs and prices, increase or decrease of tax rates, investing in the economy, etc.
	Sectoral	Competition in the industry, monopoly in the market, barriers to “entry” to the market, alternative of transition to other industries, cooperation with related industries, low purchasing capacity of contractors, etc.
	Legislative	Changes in the legal framework, arbitration practice, customs policy, logistics policy, licensing policy, protection of the internal market, changes in tax legislation, etc.
	Political	Political instability, military actions, sanctions, etc.
	Social	Strikes, absenteeism of workers, decrease in the general level of education of the population (qualification of employees), decrease in the rhythm of construction operations, etc.
	Ecological	Increase of radiation level, atmospheric pollution, soil pollution, technogenic disasters, accidents, etc.
	Geological	Occurrence of landslides, reservoir overflow (leading to flooding of the surrounding areas), revealing potential sources of deformations that are specific for the given area, etc.
	Climatic	Storm, snowfall, hail, downpour, icy conditions, tornado, etc.
Endogenous	Technological	Admission of failures in the production technology, obsolescence of technologies, incompatibility of technologies, occurrence of unexpected work activities, poor-quality materials, etc.
	Mmanufacturing	Malfunction of equipment, vehicles, mechanisms, poor-quality raw materials, failures of power supply and sanitation systems, failure or production processes stoppage for other reasons, etc.
	Operational	Depreciation of fixed assets, increasing of the number of holders of right to use infrastructure facilities, failure of the contractor to fulfill post-launch warranty obligations, etc.
	Marketing	Weak competitor analysis, failed strategy in the market, variability of demand, problems of the sales network, etc.
	Organizational	Planning and designing errors, shortcomings or coordination failures of work, shortcomings (including breach of obligations) in the design and estimate documentation, design and survey work, problems in the supply of materials (logistics system), etc.
	Innovative	Difficulties in implementing a cheaper method of production, introduction of new computer programmes, usage of new technologies, materials, etc.
	Financial	The choice of an investment object, changes in interest rates, insolvency risk, the possibility of deposit return failure, etc.
	Economic	Sales guarantee, competitiveness, incomplete construction, material and technical supply, reduction of production volumes, decrease in the rhythm of construction operations, distribution of financial resources between construction participants, etc.
	Social and labour	Labor conflicts, staff turnover, quality of working conditions, shortage and difficulties in recruitment of qualified personnel, and complexity of recruitment of qualified labor, untimely improving the skills of employees, etc.
	Specific	Unique features of construction projects, the duration of implementation period of the project, the complexity of technical means, and others

management, low staff and the governing body motivation to the real, but not declarative usage of a risk-based approach.

The implementation of the risk management system requires conditions and readiness the governing body and the staff to apply the programme, which is more contributed by the development of corporate culture in the field of risk management. In order to understand the concepts, we will distinguish the "risk culture" as the main part in the formation of the internal environment of the enterprise, the state of which risk management depends on. At a company, enterprise, or department level, personnel must be prepared to respond to risks and choose the optimal balance of risks and opportunities. In the process of forming the positions and levels of the integrated risk management system, an assessment of the conditions should be carried out taking into account the interests of each group of employees and departments.

When evaluating, it is important to have experienced groups of qualified personnel who support the ideas of risk management, while the management is carried out vertically and horizontally in order to implement the corporate risk management system and reveal the company's potential. A detailed system of incentives and encouragements is important for the staff which determines the motivation of specialists to improve their competencies for risk management. The system includes material support and financial compensation, non-material reward, socially oriented encouragement and career growth promotion.

The creation of a system has a basis in the form of qualitative and complete information support that increases the effectiveness of risk management in the enterprise. As experts point out, the achievement of minimizing, neutralizing and eliminating financial risks in the enterprise depends on the information base of risk management, which provides an indissoluble, purposeful process of selecting appropriate informative indicators for evaluation, identification and preparation of management decisions [10–12]. The initial requirements for the information base of risk management should include consistency, synchronization with the coordination structure of the risk management system; rapidity of obtaining information; completeness and uniqueness of the received data; increase of the information flow from verified sources.

According to the accuracy and regularity of the information received, the specification is based on indicators from external and internal sources of information. In the era of digitalization, the formation of an information system of financial risk management depends on the implementation of automated information technologies for financial management at the enterprise. The detailing and quality of a great amount of relevant information contributes to the accuracy of risk assessment, for which it is important to actively use "big data", which helps to process an unlimited amount of structured and unstructured data of various specifications [13]. The development of risk management based on "big data" is becoming an urgent task for the enterprise. However, despite the noted advantages, a high degree of automation, information technologies in the financial system also increase risks, reducing safety, increasing openness and insecurity in the IT sphere regarding the destructive actions of competitors.

CONCLUSIONS

Thus, we can draw the following conclusions based on our research: the activity of each construction organization is associated with risks: production, organizational, investment, marketing, technology, innovation, sectoral, social and others. In order to react in time and cope with changes in external and internal environment, construction companies must organize a flexible and efficient risk

management system. Important factors of underdevelopment of risk management in Russia are the use of global risk management technologies without taking into account the specifics of the activities of national enterprises, the general low level of risk management culture, the lack of trained personnel in this area, declarative nature of risk management, associated with the lack of real interest in the integration of risk management tools. It seems that the national trends of increasing business risk in the construction industry will act as an incentive to overcome the existing problems of the national risk management and its wide implementation not only in large, but also in medium and small organizations. Nowadays there is a tendency in Russia for increasing business risks in the construction sector and this fact is an incentive to overcome the problems of enterprise risk management in our country and its further development. A huge breakout in this field will be the introduction of risk management in the sphere of small and medium-sized construction business [14–16].

The main directions of risk management development can be "big data" technologies and reporting technologies as obligatory requirements for intrafirm accounting and risk analysis.

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Особенности развития интегральной системы риск-менеджмента на предприятиях строительной отрасли

Статья посвящена проблеме определения и учета главных свойств в развитии системы риск-менеджмента строительной отрасли. Рассматриваются такие концепции, как риск, классификация рисков, информатизация рисков, основные принципы развития системы риск-менеджмента в работе предприятий, инвестиционных проектов и процессов. Целью статьи является исследование свойств и методов улучшения эффективности деятельности строительных предприятий, основанное на развитии системы риск-менеджмента. Объектом исследования в статье является строительная отрасль и предприятия в России. Предметом исследования является специфика развития системы риск-менеджмента в данной сфере. Методами исследования являются теоретический анализ и эмпирическое исследование, в частности анализ статистических данных, а также описание и группировка данных. Информационной базой для изучения данной проблемы явились литературные источники по вопросам деятельности строительных холдингов в условиях влияния факторов внешней и внутренней среды на процесс разработки их стратегии функционирования и развития, научные статьи, монографии, электронные ресурсы, источники правового характера. Методологической основой при выполнении статьи послужили такие научные методы, как описание, сравнение, классификация.

Ключевые слова: управление, строительный бизнес, предприятие, риск, менеджмент, стратегии риск-менеджмента, внедрение, большие данные

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