https://doi.org/10.18559/ref.2020.1.2

RESEARCH PAPERS
IN ECONOMICS AND FINANCE

JOURNAL HOMEPAGE: www.ref.ue.poznan.pl

Risk management system references in construction

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ABSTRACT

The article examines the basic methods of risk management in construction: risk aversion, localization, dissipation, compensation. The methods are adapted to the specificity of construction companies, taking into account the main directions of their development. For the purpose of effective risk management, formalized functional structuring of risk management in construction is proposed, which will enable the implementation of management functions at two levels – executive and coordinating, with the help of a special structural component in the enterprise management system or a specialized unit in the organizational structure..

Keywords: construction, risk management, dissipation, localization.

1. Introduction

Risk management in construction is carried out through the preparation and implementation of measures aimed at reducing the risk of making false decisions and reducing possible negative consequences of undesirable development based on the results of the decision-making process. To ensure sustainability and competitiveness of construction enterprises, operating in a dynamic market economy and anticipation of risks of industrial and commercial activities, there is a need to develop and implement an effective organizational and economic risk management system in construction.

Efficient operation in construction depends on the ability to assess the situation, prepare and implement a range of measures to reduce and prevent the occurrence of risks. In this connection, most typical for the construction industry are the following risks: violation of the building process, disposal of fixed assets, reduction of qualitative indicators; risk of changing currency rates and prices, inflation and competition.

2. Literature review

General concepts of risk and uncertainty are considered in the works of foreign economists, e.g. Bernard, Pelley, Haley (2003). Additionally, scientists Gerasimova and Avdeyeva (2015) analyse in their work the issues of classification and the prospect of formation of an effective risk management system. Ratushniak outlines in his research work the methods of management based on qualitative and quantitative risk assessment of innovative energy-saving projects in construction (2010). In his writings, Kloman notes that the new step of risk research is "comprehensive, strategic, holistic or enterprise risk management", because it is based on the idea „to consider risks holistically rather than separately as [it] was previously [done]" (Kloman, 2000).

The authors (Mishra, Kumar, Joshi & D'souza, 2018) have conducted a thorough study of the problems of financial risks in the implementation of energy efficient projects. Within this framework, the authors have investigated a possibility of attracting additional financial

resources for the implementation of energy saving measures through the issuance of municipal bonds and compensatory financing based on deferred tax payments (Tax Increment Financing-TIF).

The study of local borrowing practices in Ukraine has shown the fragmentation of the existing system. However, by providing appropriate regulatory framework and considering the experience of other countries, the development of the local borrowing market can be a source of financial resources for the implementation of energy saving projects.

According to the results of the study of the financial countervailing technology – Tax Increment Financing (TIF), the authors (Tkachenko, Klymchuk, Ivakhnenko, Ploska, 2018) have provided suggestions for the formation of an investment mechanism for enterprises – institutional participants of the construction energy cluster, the structure of which was extracted by levers, tools, methods of financing energy saving measures; additionally, the focal point of the construction energy cluster has been identified and the participants in this integration formation have been suggested.

Chernyshev (2018) analyzed the modern practice of urban constructive innovations, which is based on the principles of biosphere compatibility. The authors analyze the project solution of providing organizational and technological reliability of construction from the point of view of the possibility of realizing the functions of a biosphere compatible city and introducing innovative constructive, architectural and planning solutions. In relation to the construction project, the formalization of the methodology for calculating the indicators of the biosphere compatibility of cities and settlements, the quantitative indicators of the implementation of the functions of the city are determined. The obtained results of numerical analysis of the realization of city functions can predict the development of urban areas, assess the comfort and safety of the urban environment from the standpoint of biosphere compatibility of construction objects in order to harmonize the characteristics of the life cycle of these projects with the characteristics of the microenvironment of their implementation. The basis of such tools is: multifactorial, multicomponent modeling and multicriterial selection of alternatives for building construction projects, provided that the level of biosphere compatibility is used as the leading analytical coordinate of such simulation. These models, implemented in the format of modern construction, will serve as a basis for organizational, technological and environmental expertise of projects.

In modern conditions, what is relevant are the studies investigating the implementation of a comprehensive approach to the prevention of risks in construction because it is presented only fragmentarily. Effective risk management practices in the construction sector of our country's economy are also insufficiently investigated. The need to explore and resolve issues related to the formation of the risk management system in construction determined the direction and structure of scientific research.

3. Methodology

On the basis of the methodology of the system approach, risk management system references have been proposed in construction. The functional structuring of risk management in construction has been developed based on the principles of hieratical, integration, formalization, comprehensiveness and optimality. The study used the existing risk management techniques in construction, which made it possible to identify the conditions which were most adaptable to the market. To increase the efficiency reserve of risk management, the authors have proposed formalized and functional structuring of risks in construction with the possibility of its realization at the executive and coordination levels of management.

4. Results and Discussion

In the modern economic environment, construction companies use different methods of reducing risk levels that have a negative impact on the process of project implementation. In practice, four types of risk management methods are used (Gerasimova & Avdeyeva, 2015). (fig. 1): risk avoidance, localization, dissipation and risk compensation.

The methods of risk avoidance are most common in business practices, used by entrepreneurs who want to be confident in their actions.

Such managers reject the services of unreliable partners and work only with verified contractors – consumers and suppliers; they do not try to expand their range of partners. In construction, a list of such methods may be the following:

– refusal to conclude a contract;
– exclusion of risky situations during project realization;
– refusal of services from unknown or doubtful suppliers, which allows for reducing the risk.

The methods of risk localization are used in the cases where it is possible to clearly identify the sources of risk. By selecting the most economically dangerous stages, businesses or process activities, one can make it controllable, and thus reduce the final risk level for a construction company. The example of the localization method in the implementation of construction projects can serve as fencing the area of conducting particularly dangerous works, the construction of individual workshops and buildings for work with special equipment, capable of damaging valuable property, etc. Localization can also be carried out through preventive measures.

The methods of risk dissipation are more adaptive management tools and involve the allocation of overall risk by combining (with varying degrees of integration) with other stakeholders interested in the success of a joint business. A construction company has the opportunity to reduce the level of its own risks, attracting other enterprises as partners in solving common problems. Relying on general integration methods, we can allocate three main types of integration in order to reduce the risk:

- vertical integration – provides for the associations of a company with its suppliers (Visser & Malan, 2019). If the company creates a consortium with suppliers of equipment, building materials (or uses a different form of association), it will be possible to significantly reduce the cost of the project and re-allocate the appropriate funds for preventive measures or save them to increase the return on investment in the project;
- horizontal integration is combining the efforts of various organizations (competitors) for the implementation of any common goals (Mishra, Kumar, Joshi & D'souza, 2018). Such integration can be implemented in the form of the association, which is beneficial to create for a few construction companies to work on large projects. Investing a significant amount in the project of one customer for a period of about 5 years is a huge risk for any company. However, dividing the customer's objects into sectors can reduce this risk by dividing the work and liability with other participants;
- circular integration is a union of organizations that perform different activities to achieve common strategic goals. For example, a construction company can create a financial group in conjunction with the leasing organization or a bank. With this integration it will receive financing for construction projects, increasing its opportunities for project coverage and sharing project risks with its partners.

The second group of risk dissipation methods is diversification, which allows for increasing variations of cooperation with suppliers of materials, equipment, customers and territory on which projects are implemented. For the implementation of productive diversification risks, the company has to adapt the experience of insurance organizations in the field of risk management, associated with the redistribution of risks in space and time, as well as various services inside the company.

Based on the above presented approaches as well as the approaches of different authors (Visser & Malan, 2019), diversification is one of the risk management methods. We propose another version of risk management method in construction companies:

- diversification of the base of customers by types of activity and organizations;
- diversification of customers by size and scale of activity;
- diversification of suppliers of equipment, building materials.

Outsourcing certain business processes of construction projects.

A very important segment in the activity of the company is suppliers. If the funds are paid for equipment, and there is no actual supply of equipment for several months, or the equipment is delivered with defects and its replacement is necessary, then the settlement of all these issues will delay the time of project implementation and the economic return on the invested funds – diversification in time. Based on the experience of insurance activity, it is necessary to consider risk implementation in time. A rational solution would be to form some provision for the alignment of loss by years; diversification of energy-saving measures is the extension of the range of company services, the use of the latest information technologies in projects that will give the opportunity to reduce the risk of specific energy efficiency activities.

The presented group of risk management methods can be adapted to the activities of construction companies in accordance with the main directions of its development:

1. Strategic planning. Strategic planning in construction must be carried out for at least 5 years, first of all, due to the average duration of the construction of buildings – from 2 to 4 years. It is advisable for a construction company, to combine the work on some projects during this period in one general plan, which includes: a direct work plan at customer objects, a plan of preventive equipment inspec-

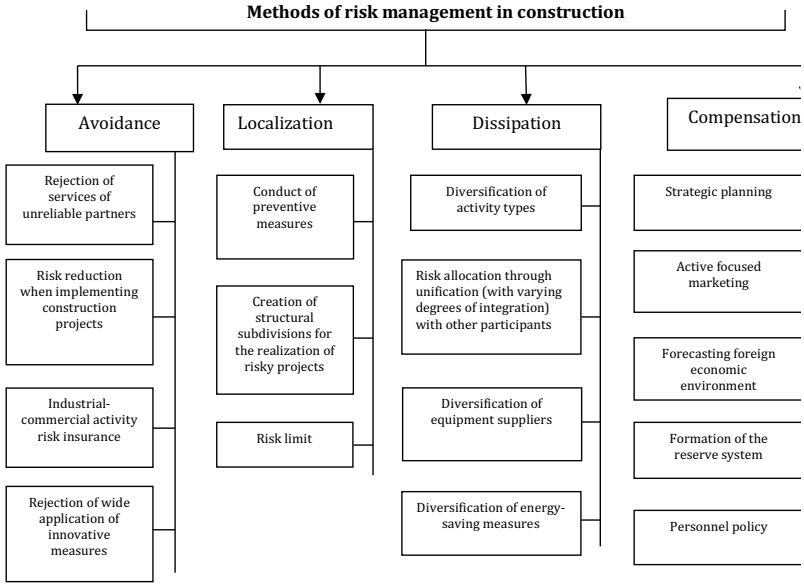

Figure 1. Risk management classification in construction
Source: based on (Kloman, 2000)

tion, an income and expense budget (to determine the cash flow for a given period of time and not to face the situation of lack of funds to calculate the obligations). Such a general plan provides an opportunity to achieve the goal of a construction company as a commercial organization and to ensure maximum involvement of labour and financial resources, to profit and remain solvent for a long-term period.

2. Prediction of the external economic situation lies in systematic estimation of the general economy and the areas in which the company implements its construction projects, to predict an economic downturn and possible accumulation of loss with only one economic sector.

3. Active targeted marketing is required in the construction company, as in any other commercial activity. Targeted marketing involves the use of tools for the intensive development of demand for the organization of products or services and market analysis:

- promotion to increase company rating and customers' attraction;
- expanding the range of performed works (application of perspective innovative or non-standard technologies in construction);
- targeting different groups of consumers with a specific set of measures for each group;
- analysis of the behaviour of competitors;
- development of competitive strategies;

4. Establishing the system of reserves. Each contract provides long-term cooperation between the developer and the customer. That is why the main criterion for the successful implementation of planned activities and obtaining returns in the form of savings will ensure the sustainability of both the company and the customer activities. The assurance of long-term financial sustainability can be achieved through the formation of the reserve system. The creation of a reserve system in construction means self-insurance in scientific terminology.

Self-insurance (internal insurance) as a way to reduce the level of risk reduction is based on the reserve organization of financial resources, making it possible to overcome the negative consequences of financial operations or other risky operations (Kloman, 2000). In other words, self-insurance involves the formation of the construction company's budget or financial fund to cover unforeseen losses. The basic forms of self-insurance are:

- formation of a reserve (insurance) fund for the elimination of the consequences of unforeseen risk situations, where 1-2% of the amount laid on the construction project is deposited;
- a reserve fund for additional preventive measures for risks detected as a result of equipment maintenance – 1-2% of the project cost;
-formation of typical consumable stocks, which the construction company applies in almost every project (cables, wiring, insulating materials, etc.), in size of 10-15% exceeding the total

amount of necessary materials, in case of additional needs;
- an undistributed profit balance, received in the reporting period, can also be considered as a reserve of financial resources aimed at eliminating the negative effects of various risks (Ratushniak, 2010).
5. The personnel policy of a construction company has a significant influence on the efficiency of work. Expensive equipment, a long term of interaction with the customer, the complexity of the calculations and works, company's guarantees – all these factors oblige to have highly qualified personnel. The main strategy of the personnel policy should be based on selecting the best staff from the labour market, motivating them with high wages, social packages and constant training.

In relation to construction activities, there are attempts to formulate a set of specialized risk management methods that have not been used previously. Therefore, the methods of risk management have been considered by the construction company, relying on the results of risk management in different spheres of the activity. For construction companies, four groups of risk management methods have been relevant to projects, i.e. risk avoidance, risk reduction, dissipation and risk compensation.

Within the framework of each group, two to five methods of risk management have been examined. Each method is considered concerning the activity of construction companies, which, given the lack of theoretical development in this field, caused some difficulties. Despite the fact that the work presents various methods of risk management, applying all the methods in each project would be inappropriate. However, taking into account a wide range of construction projects and a set of measures implemented in them; the presence of a large number of diverse external and internal risks, presented scientific and methodological development can be a guarantee of increasing the probability of successful implementation of the construction project.

The general characteristics for the presented methods of risk management is the potential opportunity to control the influence of the risk object, to ensure that there is a need for formation of an organizational risk management system in an enterprise. The process of formation of the organizational system of risk management in construction is based on the system approach methodology, which requires compliance with the laws and principles of management organization.

The analysis of the unstable environment of construction companies and the practical approaches to risk management reveals the following: risk management is generally organized on the basis of a structural and functional approach. Special infrastructure risk management in construction companies, as a rule, is not provided.

Market-based risk management techniques – hedging and insurance – predominate. There is no strategic planning in risk management; no research on potential risks is being conducted. We provide a systematic description of the risk management organizational model that has been developed in most construction companies (Table 1).

Table 1: Structuring elements of the risk management system in construction enterprises ("as-is" model)

Elements of the management system	Characteristics
Target	Preventing / reducing loss from adverse events.
Functions	Monitoring the financial condition of customers, accounts receivable; control; transfer of risk.
Tasks	Collecting, processing and registration of information concerning risk management.
Human resources	The position of a risk manager is not provided.
Risk management organization	There is no risk management department; functions, powers and responsibilities for certain types of risks (mainly financial (market) and credit) are allocated by structural and functional principles.
Methodological support	There are no internal regulations (management) on risks.
Information support	There is no full database of risks (only a part of such information is collected and registered and not in all departments)
Assessment methods of risks	Statistical; cost-effectiveness method; method of expert assessment; analytical; method of analogues.
Risk management toolkit	Risk transfer; diversification (providing services to enterprises operating in different industries).
Quantitative parameters used in the risk management system	Economic activity indicators of an enterprise (profitability, accounts receivable, efficiency indicators, liquidity), including financial ratios (debt, turnover, profitability, payback of investments, equity); market indicators.

Source: own research.

Analysing the described structuring elements of the risk management system of construction companies, it is possible to allocate a number of inherent organizational, economic and methodological problems: insignificant target orientation; a limited set of functions, tasks and principles of management that does not correspond to the spectrum of risks in production and economic activity; absence of the position of a risk manager who is competent in the field of risk management; lack of a common understanding of risk classification adaptation; limitation of risk information, with only certain types of risks collected and registered, such as financial and credit.

The main system determination approach is that the organizational structures and management methods at each stage of development must be adapted to the dynamic conditions of production functioning, scientific-based methods of analysis and substantiation of making effective management decisions. When solving the problem of risk management organization on the basis of a systemic approach, we have to consider the following:

– internal and external natural connections between the system elements and the external environment;
– the principles of the organizational management structure;
– the requirements that the organizational structure must meet to achieve the goals and objectives of enterprise management.

Management from the position of the system approach involves the creation or change of organization in the process of its functioning and development through the influence on its elements, as well as the implementation of the links themselves. Therefore, management performs a certain function aimed at maintaining the system. The organization of the management system (as a result of the realization of functions) demonstrates the organization of objectives, tasks, functions and relations between its elements, as well as the procedure and methods of obtaining, transformation and transmitting information, preservation (arrangement), the basis of which is the organizational structure (Kloman, 2000).

The specificity of industrial and commercial activity in construction influences the organizational structure of management, serving as a set of formal and informal management relations, as a way of the interrelation between the management decisions that provide effective functioning and development of the management system. The organization of risk management can be presented as a holistic formation, the interaction of elements which are directed at the achievement of certain functions, and in cases where there are such relationships between elements and their properties that changing an element or its properties leads to transformations in other elements and properties of the system control as a whole.

The nature of these relations regulates the structure of the risk management system. The structure of risk management, the degree of complexity depends on the composition and character of the functions performed by the system as a whole. The identification of the interrelations and dependencies between the risk management mechanism and the organizational management structure is one of the main tasks in the organization of the risk management system. As a basis of organizational forms of the risk management system in the construction, in the authors' opinion, is the systematic method of designing structures differentiated by the functions, and objectives of management should be laid (Ratushniak, 2010).

The main aspect of developing the systematic structure in risk management, in this case, is the analysis of risk management functions in construction. For effective implementation of risk management functions in construction, there is a need for resources. It is necessary to implement the functions of management by means of a special subsystem in the system of management of an enterprise or specialized unit in its organizational structure. This unit is a logical addition to traditionally independent functional subsystems of an enterprise. The risk management subsystem in construction can be constructed hierarchically. Taking into account the scientific works of some authors [6], we offer proposals that the process of risk management in construction is implemented on two levels – executive and coordinating (Fig. 2).

Two basic functions are realized at the executive level: firstly, continuous control of the risk level arising in the construction process, and, secondly, risk management, connected with the process of preparing solutions of all levels in an enterprise. The functions of the executive level ensure the implementation of specific risk analysis procedures during the implementation of the already accepted decisions and preparation of new management decisions. At the coordination level, the command-control procedures of coordination of all the units of the risk management subsystem in accordance with the target installations are carried out.

It is expedient to arrange the risk management procedures, that is, to specify the terms of work, form and volume of the presentation of results, to set the composition and procedure of implementation of analysis and evaluation

procedures, to prepare normative, reference and current information, to start the process of developing measures in order to reduce the risk level and bring the resulting proposals to the attention of the construction company management, to organize the implementation of anti-risk measures. This set of actions is part of the "coordination of the risk management process" function.

An optimized model of the risk management system in construction projects should be formed on the basis of solving problems inherent to the existing model, highlighted in Table 1. In the context of the systemic transformations, we provide a description of the necessary elements of the projected model, i.e. the theoretical and empirical structuring elements of the risk management system of construction projects ("as – is" model) shown in Table 2.

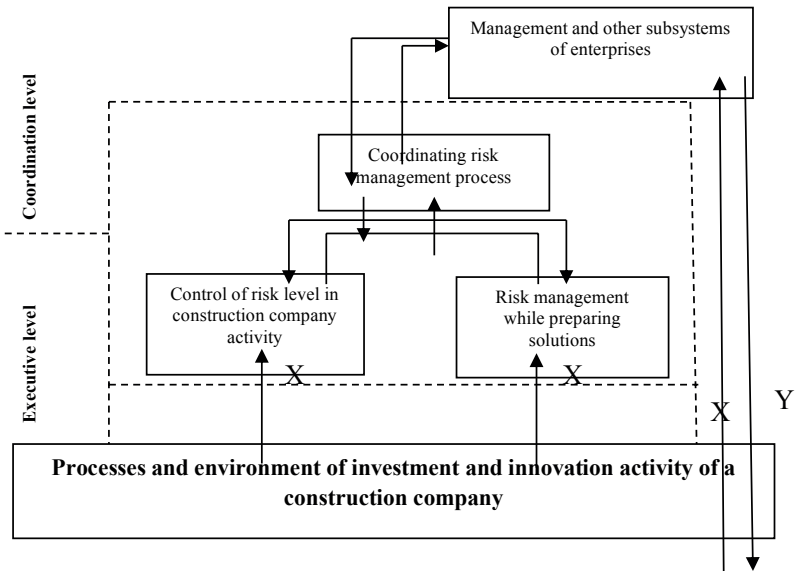

Figure 1. Risk management classification in construction
Source: based on (Kloman, 2000)

Table 2: Theoretical and empirical structuring elements of the risk management system in construction projects ("as – is" model)

Elements of the management system	Characteristics
Target	Reducing the impact on the company's external and internal adverse changes: increase of anti-crisis stability; saving resources; improving the quality of information for decision- making.
Functions	Planning (the formation of financial indicators system that determine the options for the development of a company in the case of various types of risk): organization (introduction of the risk manager position, fixing his/her responsibilities in job descriptions, development of methods and regulations); control (checking the quality of work to reduce the degree of risk, collecting information on the degree of implementation of the planned program of action); preventive measures to prevent risks.
Tasks	Organization of risk management infrastructure: regulation of risk management processes; allocation of authority and responsibility for risks; risk analysis and calculation of key indicators needed to formulate strategies, operational risk management plans; risk management costs planning (insurance, risk retention, risk manager remuneration, information support).
Principles	Systemic integrity (analysis and assessment of risks in all spheres of the company's activity); continuity (not fragmented, but established constant work of the risk management system); documenting (reports to the authorities on the work done on analysis, assessing risks with quantitative indicators, as well as calculating the cost of implementing measures to mitigate risks).
Methodological support	Regulatory risk management process, which defines key definitions, classifications, analysis and risk assessment methods, documentation, accounting, and reporting, risk management relationship with other departments.
Assessment methods of risks	Expert assessment and audit of risks: economic analysis (use of financial ratios); drafting protocols and summary table of company risks; combined methods.

Source: own research.

Considering the practical aspects of the implementation the new model, organizational and applied structuring elements of the risk management system of construction projects are presented in Table 3. The distinctive advantages of composition and content features of the modeled risk management elements system gives reason to expect that their use in practice will enable construction companies to successfully deal with the entire range of risks associated with their activities.

Table 3: Organizational – applied structuring elements of the risk management system of construction projects ("as – is" model)

Elements of the management system	Characteristics
Human resources	The risk manager position having access (on an advisory basis) to the leadership, in the future –expansion of the number of employees in this field.
The risks management organization	Establishment of risk management department; division of functions, authority and responsibility for risks: at the level of senior management – analysis of strategic risk and development of strategic management plans; at the subdivisions level – operational risk management; at the risk management department level – coordination, methodological support, consulting, information – analytical support.
Information support	Creation of a consolidated database for risk management in an enterprise that is formed on the basis of own risk research and other units of the financial department; incorporation of specialized information risk management systems.
Risk management toolkit	Transfer of risks (insurance, hedging – conclusion of contracts with suppliers concerning prices); redundancy (establishment of the risk fund); diversification, outsourcing.
Quantitative parameters used in the risk management system	Economic indicators of enterprise activity, including financial ratios; market indicators (prices, interest rate, currency exchange rates): risk ratings; cost of risks; performance indicators for the risk management system (the ratio of maintenance costs to financial results, the total loss level).

Source: own research.

5. Conclusions

The main task of risk management in construction is the proper selection of tools for the identification and classification of risk events, as well as the appropriate use of management methods. The article examines the basic methods of risk management in construction: avoidance of risk, localization, dissipation and compensation. It is adapted by the presented risk management group to the specificity of construction companies, taking into account the main directions of their development.

The study of the essence of financial risks, their direct interrelations with the strategies, targets of the company, stages of their life cycles, suggests that management should be carried out on the basis of a systematic approach. This approach, as the methodology of the research process, provides an opportunity to approach the formation of an effective risk management model for innovative projects in construction.

On the basis of analysis, the problems of risk management in construction projects, theoretical, empirical and organizational – applied structuring of the elements, have been elaborated, in which the authors have described the purpose, functions, objectives, principles, methodological support and the system of evaluation methods.

For the purpose of effective risk management, formalized functional structuring of risk management in construction is proposed, allowing for the implementation of management functions at two levels – executive and coordinating, with the help of a special structural component in the enterprise management system or a specialized unit in the organizational structure. Formalized functional risk structuring integrates management functions across coordination and executive levels.

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