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THE PROBLEM OF CHOOSING A DIVERSIFICATION STRATEGY FOR A BUILDING ENTERPRISE IN RISK CONDITION

Due to scientific and technological progress, reduced product life cycle, increased competition and permanent crisis in the economy, the task of diversifying the activity of the enterprise arises. Enterprise diversification approaches are aimed at improving the efficiency of the enterprise, increasing profits and reducing risks. The task of diversifying an enterprise is complex and has many factors of influence. The paper deals with the formal and substantive statement of the problem of choosing a rational strategy of diversification of a construction enterprise. A rational strategy is to maximize company profits while reducing risks.

The class of multicriteria decision-making methods allows to solve the task of choosing a rational diversification strategy. The analysis of some multicriteria methods has shown that the use of these methods in isolation can complicate the interpretation of the results. In addition, the wrong decision-making in case of diversification of construction companies can have serious financial consequences. It is suggested to use several methods that focus on decision-making under uncertainty to select alternatives that reflect the diversification strategies of construction companies.

The basic requirements for the construction of multicriteria decision-making methods for the choice of diversification strategies of construction enterprises under uncertainty have been formed. The main stages of decision-making on strategy selection are highlighted. The perspective of creation and implementation of information technology for the choice of diversification strategies for a construction company is outlined. It is established that the introduction of information technology of choice of strategies diversification of the company should be combined with adaptation of enterprise technologies, adjustment of organizational structure, improvement of the concept of formation of structure and volume of works in the organization of construction, etc.

Keywords: decision-making, construction company, multi-criteria task, diversification.

1. Introduction. Key factors that influence the activity of a construction company are: environmental factor (the presence of competitors, partnerships with other companies, entry into regional construction clusters), the factor of strategic management of the enterprise, organizational structure of the enterprise, productivity of the company, etc. An analysis of construction companies in Ukraine shows that about 40% of enterprises use coupled horizontal diversification strategies, 27% apply unrelated strategies, 9% use vertical strategies and almost 24% do not apply any strategy at all [1]. The answer to the question how to form an effective strategy and evaluate its effect from implementation can be the theory of adaptive strategic

management [2]. This theory includes a number of tools that allow you to dynamically regulate the activities of the enterprise, taking into account qualitative and quantitative indicators. The calculation of these indicators is a complex task that is associated with the risk and uncertainty in which the enterprise operates.

The main risks of a construction company can be attributed to: time risk (time consuming work and documentation), cost risk (any changes that occur in the course of construction projects from changes in the price of materials to changes in the construction plan), the risks of quality performance construction work and management, environmental risks, without risks.

The activities of the construction company, in particular in terms of diversification, should be consistent with the existing strategy, which is justified and positioned as rational. The urgent task is to choose a diversification strategy for the construction company that would maximize its profit taking into account the risks involved.

2. Review of sources. In [3] the features of diversification activity of enterprises are described. The task of diversifying an enterprise is complex and has many factors of influence. Multicriteria decision-making methods can be used to create an effective method of choosing a rational diversification strategy [2]. The process of multicriteria decision making and risk assessment based on fuzzy procedures is considered in [4]. The method described can be used to select diversification strategies as it implies unclear criteria. However, this method is difficult to implement and requires additional numerical research.

One of the effective methods of multicriteria decision-making is the method of hierarchy analysis [5, 6]. The method is easy to use, but it requires a large enough amount of additional information to carry out the correct ranking, which is difficult to implement under uncertainty.

Paper [7] describes the use of the Multi-Attribute Utility Theory (MAUT) method for multicriteria decision-making and risk assessment. The method can be used to select diversification strategies because it takes into account the uncertainty of the data, but the advantages of alternatives when paired must be strict.

Authors in [8] discuss the problem of linear programming for calculating performance for a decision-making unit based on the Data Envelopment Analysis (DEA) environment. Using linear DEA programming, one can measure the relative effectiveness of alternatives, which are then ranked [9, 10]. However, the method is not used under uncertainty. [11] described the method of simple weight addition (SAW). The method is based on adding estimates of goal achievement against each criterion of each alternative, taking into account the weights of these criteria. However, sometimes the results of this method do not correspond to the state of the real object of study.

The criterion space clustering algorithm can also be used to solve this problem [12]. In addition, in order to create effective diversification strategies, it is necessary to apply the forecasting of the enterprise based on its performance indicators [13, 14].

Based on the analysis of known methods of multicriteria decision-making [2] and multicriteria analysis, it can be concluded that the vast majority of methods take into account the conditions of uncertainty to some extent, but their use in isolation may complicate the interpretation of the results. Since the problem of the research is a problem that, if incorrectly resolved, can lead to significant financial losses,

it is proposed to use several methods that focus on decision making in uncertainty, relatively easily implemented and allow for the selection of alternatives that reflect the diversification strategies of construction companies. Intuitively interpret results (available quantitative or qualitative assessment scales) without the constant involvement of experts or decision makers.

3. Formulation of the problem of choosing a diversification strategy of a construction company. Let there be some construction Company B, whose main activity is the creation of real estate objects, as well as the organization of the corresponding processes during construction. The organizational structure, features of the activity and the history of creation of projects and objects of construction of this company are known. We will also assume that the activity of the company occurs under conditions of uncertainty and risk. Let Company B study find that diversification measures are needed to increase profits and reduce risks. Many diversification strategies or feasible $S = \{s_1, s_2, \dots, s_n\}$ alternatives have been developed that can be implemented by the company, that is, Company B has sufficient financial and human resources to do so, n is the number of possible diversification strategies.

Since a finite-dimensional multicriteria problem is considered, we consider the vector criterion $c(s) = (c_1(s), c_2(s), \dots, c_m(s)), s \in S$ for evaluating strategies, m is the number of evaluation criteria for alternatives. Each of the criteria may have an w_1, w_2, \dots, w_m weight that determines the importance of each criterion in evaluating alternatives, $\sum_{i=1}^m w_i = 1$. The purpose of the study is to determine a rational diversification strategy from a variety of feasible alternatives $s_j^* \in \{s_1, s_2, \dots, s_n\}$, $j = \overline{1, k}$, $k < n$ over the specified criterion space, given the uncertainty. Moreover, the result of applying the method can be both a rational diversification strategy and an ordered set of strategies $\{s_1^*, s_2^*, \dots, s_k^*\}$.

Evaluating and implementing appropriate diversification strategies will simplify the identification of risks to timely adjust the performance of a construction company under uncertainty.

Choosing the best or rational solution is the traditional approach to streamlining alternative choice schemes in a construction company. For this, the triple $\{S, O, R\}$ is often considered, where S is the set of alternatives, P is the principles of optimality or rationality, R is the conditions of choice and the results of choosing the alternative. It is clear that in order to find a solution to the problem of choosing or ranking alternatives, it is necessary to use the multicriteria analysis apparatus, and first of all, consider the multicriteria decision-making methods used in the uncertain environment.

In the decision-making process in this case, there are three main stages:

- 1) A detailed definition and description of alternatives to diversification strategies and criteria for selecting rational alternatives.
- 2) Conducting numerical calculations based on the selected multicriteria analysis method, taking into account the criteria weights, to determine appropriate alternative estimates.
- 3) Conducting the estimates obtained to select a rational alternative or rank the alternatives in order of preference for implementation according to the set of criteria described.

The core of the classic multi-criteria decision-making problem is the matrix of decision-making:

c_1	c_2	\dots	c_m
w_1	w_2	\dots	w_m

s_1	e_{11}	e_{12}	\dots	e_{1m}
s_2	e_{21}	e_{22}	\dots	e_{2m}
\vdots	\vdots	\vdots	\ddots	\vdots
s_n	e_{n1}	e_{n2}	\dots	e_{nm}

where s_j – diversification strategies, $j = \overline{1, n}$, c_i – criteria, w_i – weighting of criteria, $i = \overline{1, m}$, e_{ij} – evaluation of diversification strategies by defined criteria. That is, estimates represent $e_{ij} = c_i(s_j)$ functions. If $I_- = \{1, 2, \dots, m\}$ is the set of all indexes, $I_-^+ = \{1, 2, \dots, p\}$ is the set of indexes of the objective functions that are maximized and $I_-^- = \{p + 1, p + 2, \dots, m\}$ is the set of indices of the objective functions that are minimized, $I = I^+ \cup I^-$. Then the task can be written as follows:

$$\sum_{i \in I^+} w'_i c_i(s) \rightarrow \max,$$

$$\sum_{i \in I^-} w''_i c_i(s) \rightarrow \min,$$

$$\sum_{i \in I^+} w'_i = 1, \sum_{i \in I^-} w''_i = 1, s \in S.$$

Therefore, in order to solve the problem of multi-criteria decision making, such as choosing or ranking diversification strategies for construction companies, it is necessary to develop a multi-criteria or decision-making method that satisfies the following conditions:

- 1) Methods must provide adequate results in uncertainty.
- 2) The evaluation criteria and alternatives should adequately reflect the complex diversification processes in the activities of construction companies.
- 3) Ability to adapt methods or use other decision-making methods, as well as export results from one method to another, which would confirm or refute the results of the evaluation.
- 4) Simplicity and clarity in the interpretation of the results of the evaluation of alternatives, ie the creation of appropriate scales and descriptions of the results of the evaluation, which would facilitate the work of the decision maker.
- 5) Possibility of the decision-maker to choose other alternatives, if the proposed ones do not suit him. This is ensured by the introduction of clear advantages between alternatives.
- 6) The choice of alternative should be consistent with the resource, including financial and human, capabilities of the construction company.

- 7) Using methods for tasks with a large number of assessment strategies and criteria. Ability to relate the results obtained from the use of multicriteria methods of analysis with the goals of diversification of the company, including parameters of its performance, quantitative and qualitative indicators. This allows you to dynamically monitor the implementation of diversification strategies, adjusting them as needed.

Using these requirements, you can develop a multi-criteria decision-making method for choosing a rational or diversifying construction company strategy. This method should be based on a set of criteria, taking into account the resource. It is also possible to develop appropriate information technology that, when implemented, will increase the efficiency of the enterprise in terms of increasing profits in the medium and long term and reduce the risks of operating under uncertainty.

It should be noted that successful implementation of information technology evaluation strategy diversification of the company is only one of the components of its effectiveness. Among other things, the following activities should be taken into account:

- 1) Reformatting and improving the concept of forming the structure and scope of work in the organization of construction and implementation of diversification strategy.
- 2) Adaptation of technologies and features of activity, including peculiarities of communication between suppliers, customers, stakeholders of the company, taking into account the implementation of a rational diversification strategy.
- 3) Ability to change or adjust the organizational structure as a result of the implementation of the roadmap for the implementation of a diversification strategy.
- 4) Ability to change the technical and economic parameters of construction and other activities in accordance with the requirements of participants in the construction process based on the features of the course of implementation of diversification measures.

4. Architecture of the decision support information system for the choice of the construction company diversification strategy. According to the above requirements for the construction of multicriteria decision-making method, it is possible to form requirements for the construction of a decision support system based on this method. The architecture of the decision support system should include the following subsystems:

- 1) The storage subsystem for information on the performance of a construction company. Data are discrete time series whose elements are fixed at certain points in time (quarter, half year, year). Metrics can be both quantitative and qualitative. In order to take into account external influence, the database should include available information on the performance of competitors in the market.
- 2) The subsystem of forecasting of indicators of activity of the construction enterprise on the basis of available indicators. Prediction should be performed

by mathematical methods, taking into account the structure of the time series for the medium and short term.

- 3) Multicriteria decision-making subsystem on the choice of enterprise diversification strategy, based on the results of forecasting and taking into account the possible impact of the competitive environment. The subsystem generates many alternatives and criteria for choosing a rational diversification strategy.
- 4) The user interaction subsystem is designed to provide feedback to the user of the system, as well as to consider the opinion of the user as a decision-maker in the process of finding a multi-criteria choice problem.

5. Conclusions and prospects for further research. According to the results of the analysis, the basic requirements for the construction of multicriteria decision-making methods for the choice of strategies for the diversification of construction enterprises under uncertainty are formed to address the shortcomings of the known methods. These methods can be part of relevant decision support information systems. Formal and substantive statement of the problem of choosing a rational strategy of diversification of construction enterprises was constructed. The prospect of creating and implementing an information system for choosing a diversification strategy for a construction company is outlined, which directly influences the effectiveness of its activity. The constituent systems of decision support for the choice of strategy of diversification of activity of construction enterprises are presented.

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Лі Ю., Білощицька С. В. Задача вибору стратегії диверсифікації будівельного підприємства в умовах ризику.

Внаслідок науково-технічного прогресу, зменшення життєвого циклу продукції, зростання конкуренції та перманентних кризових явищ у економіці, виникає задача диверсифікації діяльності підприємства. Підходи диверсифікації підприємства спрямовані на підвищення ефективності діяльності підприємства, зростання прибутків та зменшення ризиків. Задача диверсифікації діяльності підприємства складна та має багато факторів впливу. В роботі розглядається формальна та змістовна постановка задачі вибору раціональної стратегії диверсифікації будівельного підприємства. Раціональна стратегія передбачає максимізацію прибутків підприємства з урахуванням зменшення ризиків.

Клас багатокритеріальних методів прийняття рішень дозволяє вирішити поставлену задачу вибору раціональної стратегії диверсифікації. Проведений аналіз деяких багатокритеріальних методів встановив, що використання цих методів ізольовано може ускладнити інтерпретацію результатів. Крім того, неправильне прийняття рішення у випадку диверсифікації будівельних підприємств може мати тяжкі фінансові наслідки. Пропонується використовувати для відбору альтернатив, які відображають стратегії диверсифікації діяльності будівельних підприємств, одразу кілька методів, які зосереджені на прийнятті рішень в умовах невизначеності.

Сформовано основні вимоги до побудови багатокритеріальних методів прийняття рішень з вибору стратегій диверсифікації будівельних підприємств в умовах невизначеності. Виділено основні етапи прийняття рішень про вибір стратегії. Окреслено перспективу створення та впровадження інформаційної технології вибору стратегій диверсифікації для будівельної компанії. Встановлено, що впровадження інформаційної технології вибору стратегій диверсифікація компанії має поєднуватись з адаптацією технологій підприємства, коригування організаційної структури, удосконалення концепції формування структури та обсягу робіт при організації будівництва тощо.

Ключові слова: прийняття рішень, будівельне підприємство, багатокритеріальна задача, диверсифікація.

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