Li Yuanyuan

Phd student, Department of Information Systems and Technology,
https://orcid.org/0000-0002-8200-4720
Taras Shevchenko National University of Kyiv, Kyiv

DEVELOPMENT OF A METHOD FOR EVALUATING DIVERSIFICATION STRATEGIES FOR MANAGING THE ACTIVITIES OF CONSTRUCTION COMPANIES

Abstract. *The model for choosing rational diversification strategies of construction companies based on an expert assessment of construction's technical and economic parameters is described, which considers the most significant indicators and the advantages of participants in the construction process. These advantages and the features of diversification strategies are included in the indicators of the diversification center, which should be created in the construction company. Since this task is complex and requires the involvement of a separate team of experts, if it is impossible to create such a center within the structure of a construction company, it is necessary to involve a consulting company that deals with this problem. The method of evaluating diversification strategies of construction companies has been improved, which is distinguished by taking into account changes in the structure of companies' organizational environments and allowing them to increase their management efficiency. This method is based on expert assessment and considers the opinions of all participants in the construction process: owners, developers, investors, general contractors and designers. In the future, the method described will be implemented in the activities of construction companies, and the obtained results will be verified. Implementing the method of formation and evaluation of diversification strategies is an essential component of ensuring the stability of the development of construction companies and obtaining their profits. The obtained results, both theoretically and practically, serve as a basis for further scientific and applied research aimed at improving various aspects of the management of construction companies. The described tools are essential practically for construction companies and holdings. In the long term, the use of the developed methods and models will positively impact the development of the country's construction industry as a whole.*

Keywords: *information technology; project management; information management; diversification strategy; construction company; project-oriented company; business process*

Introduction

The relevance of the task of diversification for construction enterprises is based on several key factors. The first factor is the demand for the development of the construction industry in conditions of rapid economic growth in countries with favorable conditions. Rapid economic growth is manifested in an increase in the country's GDP, an improvement in the population's standard of living, an increase in employment, the development of infrastructure, an increase in the volume of trade and foreign investment, etc. The People's Republic of China is known for its impressive economic growth in recent decades. This achievement was possible due to the rapid pace of industrialization, an export-oriented approach to the economy, and the comprehensive implementation of reforms. Diversification can help businesses use their resources, such as human resources, equipment, and technology, more efficiently by expanding their applications in different markets or industries. Diversification can give a construction company a competitive advantage by providing it with a more flexible and adaptive business approach, which will allow expanding the range of services to meet the needs of different customers. However, the construction industry is known for its high vulnerability to economic fluctuations and changes in the market situation, economic situation, political turbulence and conflicts.

The tasks of strategic management of enterprise activities require the application of new concepts of project and program management, described in works [1 – 6]. Features of diversification policy and investment activities are described in works [7 – 12]. Diversification is the most challenging strategy because it requires new knowledge, skills, resources, tools and technologies from the enterprise, allowing it to compete with other enterprises in a new market. An enterprise can choose diversification of activities only when there are no other opportunities for growth. The development and rational

application of diversification, particularly technological diversification, is essential for the company's development. The description of the general task of diversification of the construction enterprise and the review of scientific works in this direction is carried out in works [13; 14].

Problem statement

Formulating potential diversification strategies for construction companies can be a complex process that requires analyzing various factors, such as market conditions, financial capabilities, technical capabilities, and company strategic goals. The success of construction projects and the company's productivity depend on implementing diversification strategies. However, before implementing a diversification strategy, it is necessary to evaluate it and understand what impact this strategy will have on the company's development.

To form potential diversification strategies for construction companies, especially in conditions of uncertainty, it is necessary to first perform a market analysis in the construction industry. Market research to identify new opportunities and niches to fill. This may include assessing the demand for various construction services, identifying market trends and analyzing competitors. The next stage is the assessment of competitiveness. It involves analyzing competitors' strengths and weaknesses to identify possible market entry points or segments where the company can have an advantage. After that, a strategy must be formed, which may include developing new products or services that meet the market's needs. An approach based on expanding the range of existing services, entering new markets (regional, international), establishing new strategic partnerships, investing in the development and implementation of modern construction technologies or improving existing processes to increase the efficiency and competitiveness of the company can also be used here.

The first stage is the formation of general requirements for the diversification of the construction company. At this stage, general requirements are formulated that must be taken into account at the stage of drawing up the company's diversification strategies. In the second stage, the organizational environment of the construction company is evaluated, and the general diversification policy is formed. Evaluation of information is based on information from open sources. It is emphasized here that a diversification center should be included in the structure of the construction company. A ranked list of diversification strategies is created and evaluated in the third stage. A comprehensive evaluation of diversification strategies of construction projects involves an analysis of the costs of implementing diversification strategies and their economic effect, that is, an analysis of actual financial flows and net income of the construction company, an analysis of the number of employees involved in the implementation of the project, a

calculation of the ratio of the project cost to the value of invested assets, and as well as the intensity of costs for the implementation of the diversification strategy. In the fourth stage, the project monitoring system is being built, in which the task of diversification is implemented. Forming a system of criteria for evaluating construction diversification projects and building a list of actual projects for diversification by a construction company. At the fifth stage, the implementation of the diversification strategy is achieved. The results of implementing the diversification strategy in the construction project are evaluated at the sixth stage.

That is why several unresolved issues arise in these conditions. More studies need to be conducted regarding including a separate diversification center in the company's organizational structure, whose activities aim to form, evaluate, and choose the company's diversification strategies.

A method of evaluating diversification strategies of construction enterprises

Let a set of construction parameters be given

$$a_1, a_2, \ldots, a_s,$$

where s is the number of parameters, each of which is evaluated by a set of criteria

$$g_1, g_2, \ldots, g_k,$$

where k is the number of assessment criteria.

Also, the decision-maker should be involved in the process of selecting parameters. In addition, all the parameters considered are part of the requirements for implementing specific diversification strategies for the construction company, primarily horizontal. For example, the company was engaged in non-residential construction and decided to diversify and expand its activities by starting projects to construct and commission residential buildings. The decision-maker may represent the diversification center provided for the new structure of the construction company.

The parameters

$$a_1, a_2, \ldots, a_s$$

must reflect the objective assessments of the various components of the respective diversification strategies and not contradict each other. The diversification center forms the list of these parameters for a specific diversification strategy. Although the approach to the formation of construction parameters can be universal since economic conditions are changing rapidly, the risk of influence on the construction system of the external environment increases; it can be concluded that such a list of parameters should be formed under the code of a separate diversification strategy for a specific company, taking into account resource limitations, etc.

That is why a separate diversification center should be provided in the structure of companies.

Let B be given in diversification strategies

$$D = \{D_1, D_2, \ldots, D_B\}$$

and N experts who evaluate construction parameters to form these strategies:

$$E = \{E_1, E_2, \ldots, E_N\}.$$

The maximization set of construction parameters of the diversification strategy d and the set of parameter estimates by experts are given, respectively, in the form:

$$\overline{G}_d^e = \left\{E^e(Z_d), E^e(H_d), E^e(K_d), E^e(I_d), E^e(R_d)\right\},$$

$$d = \overline{1, B}, \quad e = \overline{1, N},$$

where Z_d is total building area, $Z_d \in R$, $E^e(Z_d)$ is assessment of the total building area for strategy d from expert e. In general, the larger the building area, the more funds the project investor will be able to receive, so this indicator is maximized. H_d is total area of residential buildings, $H_d \in R$, $E^e(H_d)$ is assessment of the residential area of the building for strategy d from expert e. Comfort $E^e(K_d)$, environmental friendliness $E^e(I_d)$ and the flexibility of the building plan $E^e(R_d)$ are subjective indicators determined by expert e.

The minimization set of construction parameters of the diversification strategy d and the set of parameter estimates by experts are given respectively in the form:

$$\underline{G}_d^e = \left\{E^e(P_d), E^e(Y_d), E^e(M_d), E^e(V_d), E^e(J_d), E^e(C_d)\right\},$$

$$d = \overline{1, B}, \quad e = \overline{1, N},$$

where P_d is the total area of the land plot, $P_d \in R$, $E^e(P_d)$ is assessment of the total land area for strategy d from expert e. Y_d is energy intensity of construction, $Y_d \in R$, $E^e(Y_d)$ assessment of energy intensity of construction for strategy d from expert e. The energy capacity (kWh/m.cubic) should be minimal in order to reduce the cost of raw materials for the production of thermal and electrical energy, therefore this parameter is minimized. M_d is material intensity of construction or the ratio of total material costs to a unit of manufactured products, $Y_d \in R$, $E^e(M_d)$ is assessment of construction material consumption for strategy d from expert e. V_d is construction cost, $V_d \in R$, $V_d \in [V_{min}, V_{max}]$, $E^e(V_d)$ is construction cost estimate for strategy d from expert e. The cost is bounded above and below for each diversification strategy and construction site. J_d is labor cost of employees, $J_d \in R$, $J_d \in [J_{min}, J_{max}]$, $E^e(J_d)$ is the estimate of the labor cost

of employees for strategy d from expert e should be minimized. C_d is duration of construction and installation works, $C_d \in R$, $C_d \in [C_{min}, C_{max}]$, $E^e(C_d)$ – the estimate of the duration of construction and assembly works for strategy d by expert e should be minimized.

Numerical points

$$G_d^e = \overline{G}_d^e \cup \underline{G}_d^e$$

are presented by e experts and entered in a separate table. Next, total scores are calculated for each construction parameter for each diversification strategy, i.e

$$X_d = \{Z_d, H_d, K_d, I_d, R_d, P_d, Y_d, M_d, V_d, J_d, C_d\}$$

and

$$E(x^d) = \sum_{i=1}^{N} E^i(x^d), \ x^d \in X_d, \ d = \overline{1, B}$$

$$E(x^d) = \frac{E(x^d)}{N}, \ d = \overline{1, B},$$

where $E(x^d)$ is assessment of construction parameters for diversification strategies $d = \overline{1, B}$ for each of the assessment categories for all experts.

General assessment of diversification strategies $d = \overline{1, B}$ will look like:

$$\Lambda^d = \frac{\sum_{x^d \in X_d} E(x^d)}{\text{card}(X_d)},$$

where Λ^d is assessment of diversification strategies $d = \overline{1, B}$.

These assessments are the basis for applying multi-criteria decision-making regarding selecting a specific diversification strategy for a construction company. The diversification strategy that receives the maximum score is optimal for implementation

$$d^* = \arg\max\{\Lambda^d\}, \ d = \overline{1, B}$$

where d^* is the optimal strategy of diversion for implementation in the activity of a construction company. All other strategies are placed in order of decreasing value Λ^d and a ranked list of rational strategies based on preferences is formed.

To conduct the analysis, we had data on the activities of the CCC company from 2010 to 2023. Until 2010, the company constructed non-residential real estate in Jiangsu Province (People's Republic of China). In 2019, the company created a new diversification sector; after studying the market, the team proposed four diversification strategies (horizontal integration), which, according to the management, could increase the competitiveness and productivity of the company. The strategy concerned four residential complexes with construction characteristics, location, area, etc. However,

the amount of funding that the team of the diversification center laid down prevented the implementation of all four strategies. The first strategy costs USD 33.5 million, the second USD 42.7 million, the third USD 55.4 million, and the fourth USD 56.8 million.

The evaluation method and decision-making model described for choosing a rational strategy were used to evaluate diversification strategies. For this, a team of experts was assembled, representing the owner, general designer, general contractor, investors and other participants in the construction process.

Based on the results of the survey, we received that strategies D_1 and D_4 received an overall average rating, and strategies D_2 and D_3 received an overall high rating, $\Lambda^1 = 15,4$, $\Lambda^2 = 17,2$, $\Lambda^3 = 16,3$, $\Lambda^4 = 13,4$. Since the second diversification strategy had the highest score, it was taken as the basis. The implementation of the project began in March 2020 and ended in December 2021. The company's actual profits for the period from 2010 to 2023 were determined. The company's profits after 2020 were also calculated, which are obtained based on the result of forecasting without taking into account the implementation of the chosen diversification strategy, that is, before the implementation of the strategy. Initially, there was a decrease in profits due to an increase in the volume of expenses for implementing the diversification strategy

D_2, but as of 2023, there was an increase. In this way, obtaining a profit as of 2023 was possible, which exceeds the forecasted indicators by 11.1%.

Conclusions

1. The model for choosing rational diversification strategies of construction companies based on an expert assessment of construction's technical and economic parameters is described, which considers the most significant indicators and the advantages of participants in the construction process. These advantages and the features of diversification strategies are included in the indicators of the diversification center, which should be created in the construction company. Since this task is complex and requires the involvement of a separate team of experts, if it is impossible to create such a center within the structure of a construction company, it is necessary to involve a consulting company that deals with this problem.

2. The method of evaluating diversification strategies of construction companies has been improved, which is distinguished by taking into account changes in the structure of organizational environments of companies and allowing them to increase the efficiency of their management. This method is based on expert assessment and considers the opinions of all participants in the construction process: owners, developers, investors, general contractors and designers.

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Лі Юаньюань

Аспірант кафедри інформаційних систем та технологій,
https://orcid.org/0000-0002-8200-4720
Київський національний університет імені Тараса Шевченка, Київ

РОЗРОБКА МЕТОДУ ОЦІНЮВАННЯ СТРАТЕГІЙ ДИВЕРСИФІКАЦІЇ ДЛЯ УПРАВЛІННЯ ДІЯЛЬНІСТЮ БУДІВЕЛЬНИХ КОМПАНІЙ

Анотація. Описано модель вибору раціональних стратегій диверсифікації будівельних компаній на основі експертного оцінювання техніко-економічних параметрів будівництва, який враховує найбільш значущі показники і дає змогу врахувати переваги учасників будівельного процесу. Ці переваги, а також особливості стратегій диверсифікації закладаються в показники центром диверсифікації, що має бути створено в будівельній компанії. Оскільки ця задача складна і потребує залучення окремої команди експертів, то в разі, якщо створити такий центр у структурі будівельної компанії неможливо, потрібно залучати консалтингову компанію, яка займається цією проблемою. Удосконалено метод оцінювання стратегій диверсифікації будівельних компаній, що відрізняється врахуванням змін у структурі організаційних середовищ компаній і допомагає підвищити ефективність управління ними. Цей метод заснований на експертному оцінюванні і передбачає врахування думок всіх учасників будівельного процесу: власників, забудовників, інвесторів, генпідрядників та генпроєктувальників. Надалі планується впровадження описаного методу в діяльності будівельних компаній та верифікація отриманих результатів. Впровадження методу формування і оцінювання стратегій диверсифікації є важливим компанентом забезпечення стабільності розвитку будівельних компаній та отримання ними прибутків. Отримані результати, як у теоретичному, так і практичному плані, служать основою для подальших науково-прикладних досліджень, спрямованих на удосконалення і покращення різних аспектів управління будівельними компаніями. Описані інструменти є практично важливими для будівельних компаній, холдингів. У довготривалій перспективі використання розроблених методів і моделей дасть позитивний вплив на розвиток будівельної галузі держави в цілому.

Ключові слова: інформаційна технологія; управління проєктами; інформаційний менеджмент; стратегія диверсифікації; будівельна компанія; проєктно-орієнтована компанія; бізнес-процес

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