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O. Bielienkova
Doctor of Economics, Associate Professor of the Department of Construction Economics
bielienkova.oiu@knuba.edu.ua, orcid.org/0000-0002-1142-5237
Kyiv National University of Construction and Architecture, Kyiv, Ukraine

K. Izmailova
Candidate of Economic Sciences, Associate Professor of the Department of Construction Economics
staskat@ukr.net, orcid.org/0000-0001-8460-110X
Kyiv National University of Construction and Architecture, Kyiv, Ukraine

Y. Zapiechna
Candidate of Economic Sciences, Associate Professor of the Department of Construction Economics
zapiechna.iuo@knuba.edu.ua, orcid.org/0000-0003-3333-9900
Kyiv National University of Construction and Architecture, Kyiv, Ukraine

Y. Loktionova
Candidate of Economic Sciences, Associate Professor of the Department of Construction Economics
loktionova.yaf@knuba.edu.ua, orcid.org/0000-0001-5634-4900
Kyiv National University of Construction and Architecture, Kyiv, Ukraine

DEPENDENCE OF COMPETITIVENESS ON THE LEVEL OF BUSINESS CONFIDENCE OF THE ENTERPRISE

Abstract: The article deals with the issue of ensuring the competitiveness of construction contractors depending on the level of business confidence, which is esteemed as the amount paid on schedule construction contracts. To improve the competitiveness of enterprises the authors propose indicators to identify the existing potential for efficiency enhancement and ensuring competitiveness depending on the level of business confidence of the enterprise. Indicators of competitiveness of construction companies are determined by fuzzy sets, including pricing policy, the efficiency of fixed assets and the level of diversification. The main direct and indirect factors of competitiveness of the contracting enterprise are outlined.

Keywords: competitiveness, level of business confidence, economic trust, business model of the enterprise, financial indicators, economic security.

Introduction

At first glance, competition is a rather unambiguous concept, which coincides with a direct translation from the Latin definition of «concurrentia», which means rivalry or competition. But the complexity of this concept is proved by many attempts in economics to determine the essence of this definition, the forms of its manifestation, to identify factors influencing the macro-, meso-, micro-levels of economic systems. A wide range of researchers have joined the ongoing scientific discussion on defining the essence of this category and the concepts of «competitiveness» and «competitive stability «derived from it. Scientists from the world's leading schools have been studying theoretical principles and manifestations of competition

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for more than two centuries. However, Ukrainian scientists joined them only a few decades ago, after a long hiatus when the country was building a planned rather than a market economy. Prominent scholars have studied various aspects of competition at the level of countries, sectors of the economy, and economic entities, but it has not yet been possible to obtain an unambiguous answer about the nature of competitiveness as a process or phenomenon. In [1] it is noted that "as an economic category, competition is an economic rivalry and struggle between private and collective producers and sellers of goods and services for the most favorable conditions of their production and sale, for receiving the largest profits, which spontaneously regulates the proportions of public production".

The concepts of «competitiveness», «competition» change, deepen, take on a new form and new facets along with the development of research on economics, reflecting its genesis over time. Therefore, it is very important to study the research literature in historical perspective and in the context of the development and formation of the concepts of «competition», «competitiveness», scientific generalization and identification of current trends and areas of research, formation of competitive advantages of individual business entities as a theoretical basis for further research.

Literature Review

The concepts of «competitiveness», «competition» change, deepen, take on a new form and new facets along with the development of world economic thought, reflecting its genesis over time. Thus, different authors identify different factors of competitiveness: resources and market environment [2], [3], innovation – [4, 5], choosing a successful strategy of coexistence [6] or creating their own spaces for competition, the so-called «blue oceans» – spaces where the company will be the only player or leader [7], ensuring proximity to consumers, taking into account their requirements, leadership in the development of new products [8, p. 85-91], formation of a balanced corporate culture and interaction with consumers [9, p. 42], knowledge management [10], business model [11], organizational culture [12] and others.

Aims

The purpose of the study is to identify factors to ensure the competitiveness of the enterprise in the long run, which means the percentage of winning tenders among the total number of tender offers of the company. Contracting construction companies operating on the Ukrainian market during 2015-2021 were selected as representative companies.

The initial data were obtained based on the results of the analysis of the activity and efficiency of the selected contractors in the tenders for construction works on the Prozorro platform [13]. The authors studied indicators of 19 contracted construction enterprises which specialize in general construction work and road construction.

Results and methods

It is proposed to define the competitiveness of the contractor as a share of tender proposals that were not rejected for technical, organizational, financial and other reasons among the proposals in the total number submitted by the enterprise. The study took into account only the tenders with the factor «lowest price» (y) as the criterion for selecting the winner [14]. The increase or decrease in the contractor's competitiveness was estimated for six months.

It is assumed that the potential competitiveness of the contractor «y» is formed as a result of the following important factors [15-16]:

x_1 – *diversification (concentration)* of activity. The need for research and the importance of the impact of this factor on the competitiveness of enterprises is emphasized in [17-23]. In this study, it is defined as the ratio of current licenses for various activities of the construction

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company to the average number of current licenses in the sample. There are two states of activities «diversified activity» – the ratio is greater than one, «concentrated activity» – the indicator is less than or equal to one;

x_2 – *efficiency of fixed assets*. It is calculated as the ratio of sales revenue to the average cost of fixed assets. It demonstrates the company's ability to effectively use material and technical resources, manage personnel, and optimize the number of its own construction machines and mechanisms at the sites;

x_3 – *flexibility of pricing policy*. The indicator is calculated based on the results of competitive bidding of the analyzed enterprises for the respective year. If the data in the database for the year were missing, the indicator was determined on the basis of interpolation or extrapolation of data. It is calculated as the average percentage of tenders in which the company is the winner, to the initial price of the tender offer of this company in the relevant competition;

x_4 – *the level of business confidence of the company*. In contrast to the indicator, which is calculated in the article [14], it is counted as received payments in accordance with the executed contracts for the reporting period. The indicator characterizes the company's confidence in receiving funds during the implementation of the contract. The highest value of the indicator is observed in periods of growth of business activity in the ascending phase of the economic cycle, the lowest happens during the reduction of business activity in the phase of «decrease», when companies fail to execute some contracts not because of the contractor, but as a result of lack of funding, or reasons that depend on the customer. The indicator, in contrast to the coefficient used in the work [14], characterizes only the impact of the external environment on the competitiveness of the enterprise.

According to the algorithm, which is detailed in [14, 26, 27], a fuzzy inference system was created by means of the Matlab Fuzzy Logic Toolbox software package using a fuzzy inference system of the Sugeno type. In this case, systems such as Sugeno is the result of the design and training of a fuzzy hybrid model.

The hybrid method with error level 0 and number of cycles 30 was chosen for hybrid network training, as a result of network training the error was 0.096 percentage points, which is enough to diagnose the competitive potential.

For the input factors $x_1 - x_4$ and the resultant y we obtain the model «four inputs-one output» (Fig. 1).

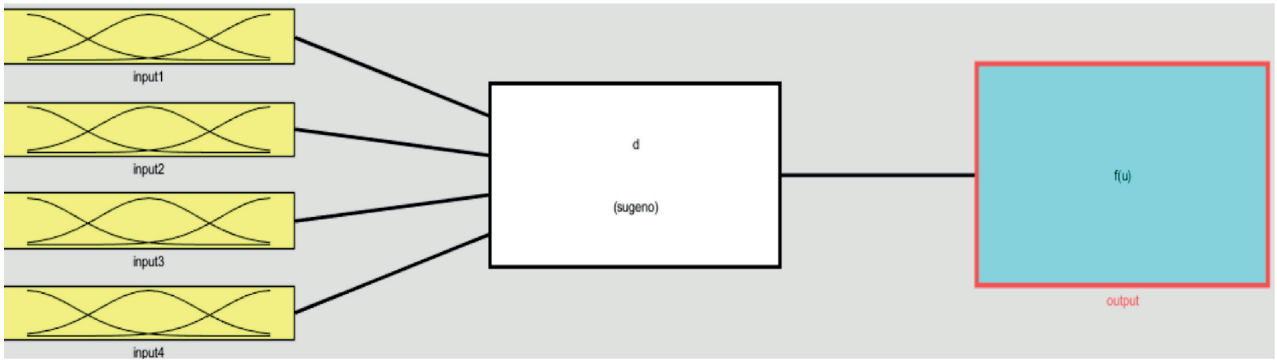

Fig. 1. Model of influence of factors $x_1 - x_4$ on the competitiveness of the contractor

With the help of membership functions of input variables falsification is carried out, i.e. the transition from numerical parameters of input variables to fuzzy values of linguistic variables. That is, membership functions for the terms of variables $x_1 - x_4$, which allow for any value from a series of input data to determine its degree of belonging to a fuzzy set, with both input vari-

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ables given three membership functions of type gaus2mf (double Gaussian function), which specifies the combination membership functions in the form of a combination of two Gaussian curves and has the following form [24, p. 199]:

if $b_1 < b_2$

$$\text{then}, \mu(x) = \begin{cases} \exp((\mathrm{x} - \mathrm{b}_1)^2 / (-2c_1^2)), x < \mathrm{b}_1; \\ 1, \mathrm{b}_1 \le x \le b_2; \\ \exp((\mathrm{x} - \mathrm{b}_2)^2 / (-2\mathrm{c}_2^2)), \mathrm{x} > \mathrm{b}_2. \end{cases}, \quad (1)$$

if $b_1 > b_2$

$$\text{then}, \mu(x) = \begin{cases} \exp((\mathrm{x} - \mathrm{b}_1)^2 / (-2c_1^2)), x < \mathrm{b}_2; \\ \exp((\mathrm{x} - \mathrm{b}_1)^2 / (-2\mathrm{c}_1^2) \exp(\mathrm{x} - \mathrm{b}_2)^2 / (-2\mathrm{c}_2^2)), \mathrm{b}_2 \le x \le b_1; \\ \exp((\mathrm{x} - \mathrm{b}_2)^2 / (-2\mathrm{c}_2^2)), \mathrm{x} > \mathrm{b}_1. \end{cases}, \quad (2)$$

where $\mu(x)$ – is the measure of x belonging to some fuzzy set;

if $b_1 < b_2$

$b_1 \, i \, b_2$ – lower and upper limits of the fuzzy set kernel;

$c_1 \, i \, c_2$ – the concentration coefficient of the left and right branches of the graph of the membership function.

if $b_1 > b_2$ then the fuzzy set turns out to be subnormal.

According to the parameters of Gaussian membership functions for the terms «concentrated activities» and «diversified activities» of the contractor. The degree of diversification of activities among the analyzed contractors ranged from 0 to 3.93.

The maximum level of confidence in the level of concentration of activities is less than 1.18 in the case of the index value, because the parameter $b2 = 1.18$. That is, contractors who have a number of licenses relevant for the relevant period for different activities, have a high level of concentration. Companies with a low level of concentration or a high level of diversification have 2,742 times the average number of licenses.

When the value of the index of construction activities is less than 1.18, the company has an indisputable affiliation to the term «concentrated activity» for the factor x_1.

$$\mu_c(x_1) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_1 - 1{,}18}{0{,}661}\right)^2}, if\ x_1 \ge 1{,}18 \\ 1, if\ x_1 < 1{,}18 \end{cases} \quad (3)$$

$$\mu_d(x_1) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_1 - 2{,}742}{0{,}6633}\right)^2}, if\ x_1 \le 2{,}742 \\ 1, if\ x_1 > 2{,}742 \end{cases} \quad (4)$$

The graph (Fig. 3) presents the membership functions for the terms «low level of resource efficiency», «average level of resource efficiency» and «high level of resource efficiency». The ratio of revenue from sales of products, works of services to assets of the analyzed enterprises ranged from 0.1 to 2.5 times.

The low level of efficiency is the level of resource efficiency less than 0.4595, because because the parameter $b1 = 0.4595$. That is, contractors who could not reach UAH 0.46. net income per 1 UAH. assets that operate inefficiently. The average level of resource efficiency is from UAH 0.93 to UAH 1.66. for 1 UAH. assets of enterprises, and unquestionably high – UAH 2.15. for 1 UAH. assets.

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$$\mu_h(x_2) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_2-3,41}{0,4122}\right)^2}, if\ x_2 \le 3,41 \\ 1, if\ x_2 > 3,41 \end{cases} \quad (5)$$

$$\mu_{av}(x_2) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_2-1,129}{0,412}\right)^2}, if\ x_2 \le 1,129 \\ 1, if\ 1,129 < x_2 < 2,83 \\ e^{-\frac{1}{2}\left(\frac{x_2-2,83}{0,4113}\right)^2}, if\ x_2 \ge 2,83 \end{cases} \quad (6)$$

$$\mu_l(x_2) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_2-1,02}{0,4107}\right)^2}, if\ x_2 \ge 1,02 \\ 1, if\ x_2 < 1,02 \end{cases} \quad (7)$$

The affiliation functions for the terms “rigid pricing policy”, “moderate pricing policy” and “flexible pricing policy” show that the level of reduction in the value of tender offers in the analyzed enterprises ranged from 0 to 31%.

At the same time, the level of price reduction of less than 3.372% is considered to be a harsh pricing policy, because the parameter $b1 = 0.03972$. That is, contractors who reduce the cost of tenders by less than 3.972% on average are guaranteed to adhere to a strict pricing policy. The moderate pricing policy is at the level of discount from 10.77 to 19.9%, and unquestionably flexible – at the level of reduction of more than 25.5%.

$$\mu_r(x_3) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_3-0,13}{0,03972}\right)^2}, if\ x_3 > 0,13 \\ 1, if\ x_3 \le 0,13 \end{cases} \quad (8)$$

$$\mu_m(x_3) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_3-0,1077}{0,01987}\right)^2}, if\ x_3 \le 0,108 \\ 1, if\ 0,108 < x_3 < 0,199 \\ e^{-\frac{1}{2}\left(\frac{x_3-0,199}{0,0243}\right)^2}, if\ x_3 \ge 0,199 \end{cases} \quad (9)$$

$$\mu_f(x_3) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_3-0,255}{0,0414}\right)^2}, if\ x_3 \le 0,255 \\ 1, if\ x_3 > 0,255 \end{cases} \quad (10)$$

The level of business confidence in the previous period ranged from 0 to 1 among the surveyed enterprises. It is calculated in a similar way. At the same time, there is absolute certainty that the environmental benefits are low, if the percentage of timely payments under contracts in the previous period was below 13.2%, moderate – 30-61%, and high – 82.2%.

$$\mu_h(x_4) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_4-0,822}{0,0848}\right)^2}, if\ x_4 \le 0,822 \\ 1, if\ x_4 > 0,822 \end{cases} \quad (11)$$

$$\mu_{av}(x_4) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_4-0,35}{0,08022}\right)^2}, if\ x_4 \le 0,301 \\ 1, if\ 0,301 < x_4 < 0,6103 \\ e^{-\frac{1}{2}\left(\frac{x_4-0,6103}{0,08398}\right)^2}, if\ x_4 \ge 0,6103 \end{cases} \quad (12)$$

$$\mu_l(x_4) = \begin{cases} e^{-\frac{1}{2}\left(\frac{x_4-0,132}{0,07901}\right)^2}, if\ x_4 \ge 0,132 \\ 1, if\ x_4 < 0,132 \end{cases} \quad (13)$$

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By default, the MatLab Anfis-editor add-in develops and tests fuzzy inference algorithms with rules in which the combination of input variable terms is a complete set of all possible combinations of input variable membership functions in the designed Sugeno constant system.

Since the system has three input variables, each of which has three terms and one variable – two terms, the maximum number of rules in the knowledge base to formulate all possible relationships between factors and consequences should be 2 * 33 = 54. However, not all rules are needed to adequately reflect the relationship between inputs and outputs. In order to enable the sustainable development of contractors, 38 rules were selected from all dependencies, the rules reflect the main provisions of an arbitrary or forced strategy of forming sources of financing for a construction contractor.

The rules are formulated as follows (fragment):

1. If the contractor has a high level of concentration, high efficiency of fixed assets, has a flexible pricing policy, but has a low level of business confidence, the level of competitiveness is determined by mf2.

2. With the concentration of activity, high level of efficiency of fixed assets, moderate pricing policy and low level of business confidence, the competitiveness of the enterprise will be calculated as mf4.

3. In the case of diversified activities, flexible pricing policy, high level of efficiency and high level of business confidence, the competitiveness of the contractor will be closer to mf36.

These rules reflect the main provisions of an arbitrary or forced strategy to ensure the competitiveness of the contractor. Thus, in accordance with the established rules, with a low level of efficiency of the contractor's fixed assets, the growth of competitiveness is possible under the condition of concentration of activity. And with a sufficient level of resource efficiency, it is recommended to diversify activities to increase competitiveness. When the level of efficiency of fixed assets is above average, then diversification or concentration of activities do not have a sufficient impact on the resulting indicator.

Diversification as a means of achieving competitive advantage can be recommended to contractors in case of a strict pricing policy, and, on the contrary, in case of a flexible or moderate one, concentration should lead to an increase in the level of competitiveness. With a tight pricing policy, contractors want to expand their activities to increase their competitiveness.

With a high level of business confidence of the company, the concentration of activities will be effective. The lowest level of competitiveness have contractors, whose low level of business confidence is combined with diversification of activities, which leads to «scattering» efforts to promote the company in the markets, participation in excess of various types of tenders, leading to increased transaction costs, and ultimately, reduces its competitive advantage in all markets. In this case, the contractor is encouraged to focus on one or more activities, improving competitive positions in a limited number of markets (Figure 2).

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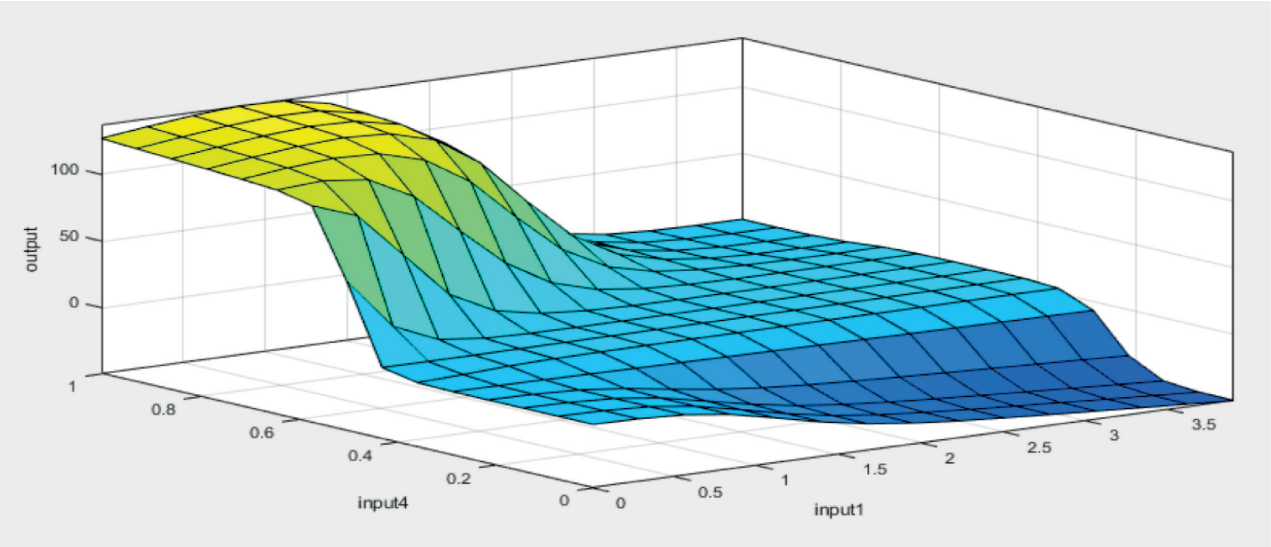

Fig. 2. Influence of parameters x_1 and x_4 on the resulting indicator *y*

The level of efficiency of fixed assets has almost no effect on the competitiveness of the contractor. Thus, with a low level of business confidence, the competitiveness of enterprises has a low level and with the growth of the factor x4 – also increases (Fig. 3).

The resultant indicator reaches the greatest value at a combination of a high level of business confidence and a rigid price policy. Flexible prices can slightly increase the level of competitiveness at a low level of business confidence, while at a high level of business confidence flexible pricing policy leads to a loss of competitiveness (Fig. 4).

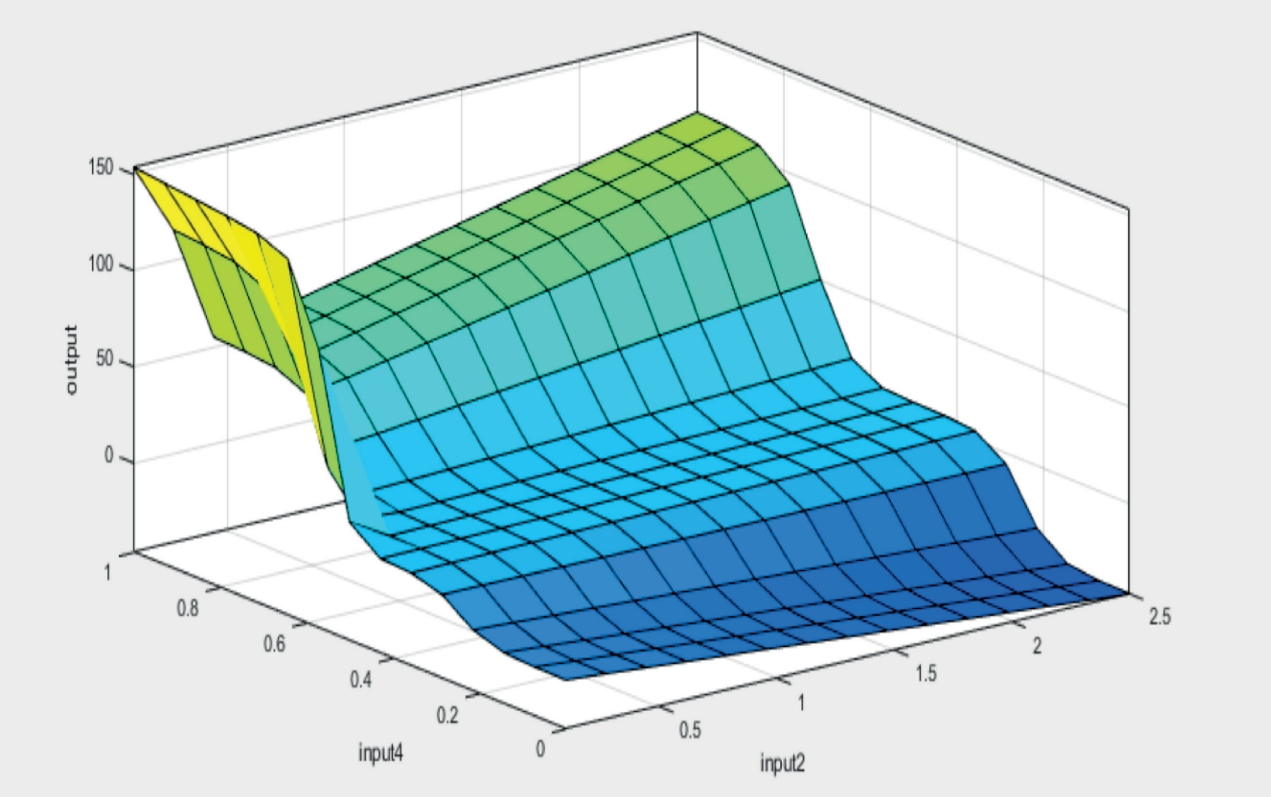

Fig. 3. Influence of parameters x_2 and x_4 on the resulting indicator *y*

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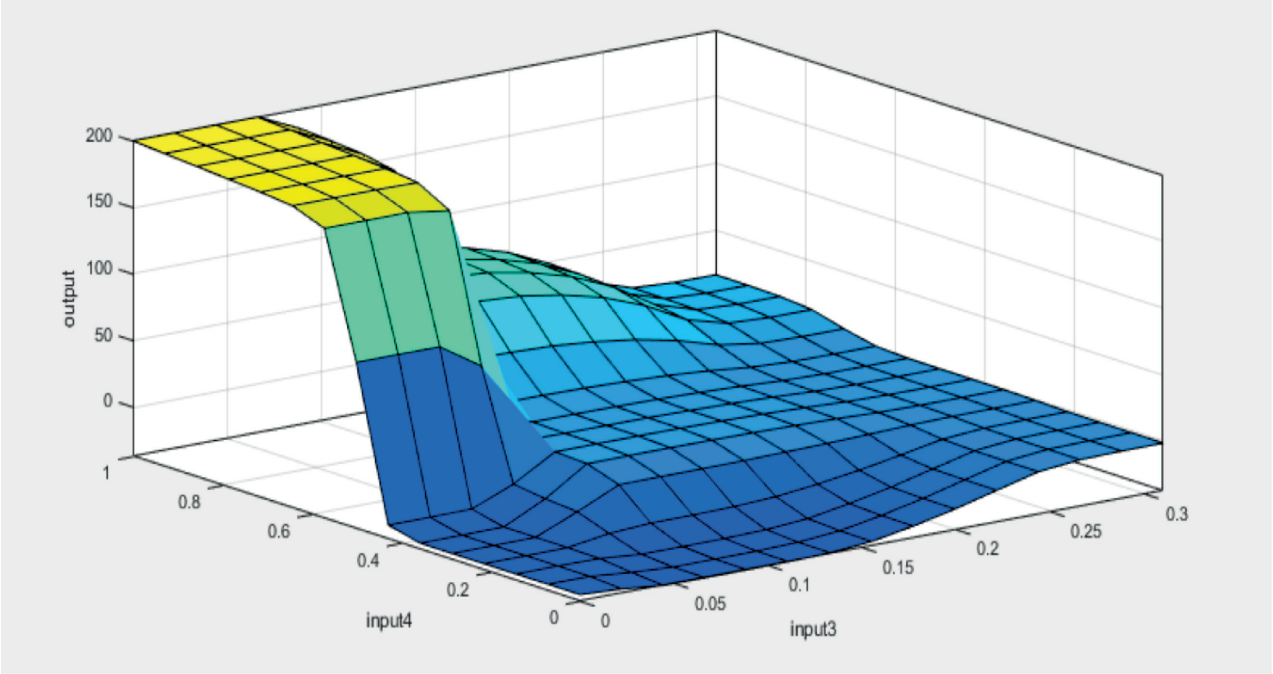

Fig.4. Influence of parameters x_3 and x_4 on the resulting indicator y

At the second stage «Logical conclusion» the measure of truth of the conclusion of each of rules of base of knowledge on the basis of truth of their preconditions is defined. Ensuring the competitiveness of the contractor is possible if all four conditions are met, which, however, are unequal. In the theory of fuzzy sets, the simultaneous satisfaction of the preconditions of several rules of fuzzy sets is determined by the operation of the minimum. That is, the competitiveness of the contractor will correspond to the minimum value of the mathematical expectation of each of the conditions [14, 26, 27]:

$$\mu_{\text{конкур}} = \left(\mu_{nec}(x_1)\right)^{\omega_1} \wedge \left(\mu_{nec}(x_2)\right)^{\omega_2} \wedge \left(\mu_{nec}(x_3)\right)^{\omega_3} \wedge \left(\mu_{nec}(x_4)\right)^{\omega_4}$$
$$\Updownarrow \qquad (14)$$
$$\mu_{\text{конкур}} = \min\left(\left(\mu_{nec}(x_1)\right)^{\omega_1}; \left(\mu_{nec}(x_2)\right)^{\omega_2}\left(\mu_{nec}(x_3)\right)^{\omega_3}; \left(\mu_{nec}(x_4)\right)^{\omega_4}\right)$$

The four components of a contractor's competitiveness can be divided into partially managed – two factors, one of which reflects its internal ability to maintain sustainable development (efficiency of fixed assets), favorable business environment (business confidence which depends on the favorable macro- and mesoeconomic environment, market development and business reputation and pricing policy of the enterprise), and fully managed by the enterprise – flexibility of prices for construction works and concentration of activities.

Partially managed factors have gained more weight, because their management in market conditions for contractors is limited and they carry a greater degree of risk, and fully managed less, because in the formation of sustainable development strategies, companies must operate on them. With:

- concentration of activities and pricing policy $j_1 = j_3 = 3{,}5$;
- resource efficiency and business confidence $j_2 = 2$; $j_4 = 1$.

The values of the weight of each rule, calculated by the formula (1), are given in table. 1.

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Table 1. The importance of factors in the competitiveness of development companies using the resulting fuzzy set

The indicator for which the term is defined "The level necessary to ensure competitiveness"	Weighting factor
Concentration	$\omega_2 = \frac{2 \bullet (4 — 3{,}5 + 1)}{4 \bullet (4 + 1)} = 0{,}15$
Resource efficiency	$\omega_1 = \frac{2 \bullet (4 — 2 + 1)}{4 \bullet (4 + 1)} = 0{,}3$
Pricing policy	$\omega_2 = \frac{2 \bullet (4 — 3{,}5 + 1)}{4 \bullet (4 + 1)} = 0{,}15$
Business confidence	$\omega_1 = \frac{2 \bullet (4 — 1 + 1)}{4 \bullet (4 + 1)} = 0{,}4$

Thus, the quantitative measurement of compliance of the current level of competitiveness with the conditions necessary for sustainable development is determined by calculating the degree of acceptance of the current state by substituting the data of each individual enterprise in the formula (15):

$$\mu_c = \min\left(\left(\mu_{nec}(\mathrm{x}_1)\right)^{0{,}15}; \left(\mu_{nec}(\mathrm{x}_2)\right)^{0{,}3}; \left(\mu_{nec}(\mathrm{x}_3)\right)^{0{,}15}; \left(\mu_{nec}(\mathrm{x}_4)\right)^{0{,}4}\right) \quad (15)$$

The result of formula (15) reflects the tactical competitive potential of the contractor, expressed in units. That is, the measure of compliance of the current level of competitiveness with the requirements of sustainable development can be used as an additional reducing factor in the income formula «extreme pessimism» [28].

Conclusion

It is proposed to assess the level of ability of contractors to maintain and improve competitive positions by using a hierarchical algorithm such as Sugeno based on input variables, the level of concentration, resource efficiency, the flexibility of pricing policy and business confidence, which allowed . The proposed system of assessing the competitiveness of the contractor allows you to identify factors that are key to sustainable development and influence them, forming competitive advantage in the long run.

A system of indicators that can serve as indicators of a high level of potential for sustainable development of contractors and developers, including the growth of market share, growth of assets, financial stability, which is supplemented by subgroups of indicators: reputation component, concentration-diversification of activities, level of market confidence. Factors that shape the competitiveness of development companies are financial stability, reputational component and resource component, and contractors – business confidence, financial stability, resource efficiency and flexibility of pricing policy. The supplemented classification provides a better justification for decisions on the management of construction companies and can be taken as a basis for targeted management of the competitiveness of both developers and contractors.

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