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Modeling the Business Environment of an Energy Holding in the Formation of a Financial Strategy

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Abstract: This article consists of the development of a set of methodological provisions concerning the identification of the features of the influence of the business environment on the effectiveness of the implementation of the company's financial strategy and the development of a system for its adaptation to the conditions of a dynamic external environment. The purpose of this article is to build an economic and mathematical model to identify the main elements of the business environment that affect the company's strategy, the formation of methods for evaluating the effectiveness of the implementation of a financial strategy taking into account such influence. The author's contribution consists in the development of an effective financial algorithmic strategy of the energy holding, considering the influence of the environmental factors. Hypothesis: the use of mathematical models of the business environment will increase the efficiency of energy holding management in the field of finance and investments. The scientific novelty of this article lies in the development of an algorithm that allows for obtaining an integral assessment of the impact of external and internal factors of the energy holding's business environment on its financial strategy using taxonomy methods, multidimensional statistical analysis and cluster and discriminant models. Results: the authors have developed a model of the influence of the energy holding's business space, which allows improving the interaction of financial flows within the holding and obtaining an optimal distribution of financial resources, taking into consideration the dynamic factors of the company's external environment.

Keywords: financial analysis; energy holdings; financial strategy; environment

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1. Introduction

Modern conditions of the functioning and development of industrial complexes, in general, and production facilities and enterprises, in particular, are characterized by uncertainty and ambiguity of the influence of the external environment, increased competition, the emergence of new market participants and products, increased globalization processes and the formation of new requirements from consumers. A characteristic feature of the functioning of modern enterprises is that the orientation towards maximum efficiency has been replaced by an orientation towards economic development. Constantly changing working conditions caused by fluctuations in the external environment create an imbalance between existing production opportunities and possible alternatives to the economic development of the enterprise.

At the same time, it should be noted that the specifics of the interaction of an enterprise with its environment and business environment are not limited to direct relationships but

are characterized by a significantly higher level of complexity and subordination. Thus, the activity of an industrial enterprise is significantly influenced by economic (economic policy of the state, taxation system, inflationary fluctuations, market conditions, development of market infrastructure, investment attractiveness of the country, etc.), political (stability of the government, development of the legislative framework, the nature of government–business relations, etc.), social (labor potential of the region, population dynamics, level and quality of education of potential employees, etc.) and technological (technical and technological development, the results of the introduction of scientific and technological progress, prospects for the production of domestic equipment, etc.) environmental factors.

The conditions of instability and uncertainty, the constant impact of the external environment and competition require the enterprise to create such a system of countering destabilizing factors that would ensure its effective functioning, the ability to resist not only the threat of destruction of the organizational structure and status but also obstacles in achieving key development goals.

Thus, these circumstances necessitate the development of a comprehensive adaptive mechanism that will ensure the response of the enterprise to the impact of external factors in terms of ensuring its competitiveness and sustainability as well as the adaptation of the financial strategy to the dynamism of the environment.

The financial strategy of the company is one of the main plans for business development in the future. The forecast of the development of the business environment is the basis for the formation of strategic plans and programs. The need to adapt the financial strategy of an enterprise to changes in the external environment necessitates the need to make certain adjustments to its internal systems and divisions in order to ensure that their functioning corresponds to the state of the business environment. There is no doubt that the introduction of appropriate changes should be carried out comprehensively and purposefully in a certain order using a systematic approach, which requires the organized management of this process.

The task of analyzing the impact of the business environment on the effectiveness of the implementation of the financial strategy of the enterprise and, accordingly, substantiating the directions for improving the mechanism of its adaptation to disturbances and turbulence of the external environment is especially relevant for domestic industrial holdings since they form a significant share of the economic potential of the country; however, as a result of the adverse impact of business environmental factors, the stability of their functioning is disrupted and financial stability and the level of competitiveness are reduced.

In this context, we note that the problem of research and the assessment of the impact of the business environment on the effectiveness of the company's financial strategy, as well as the organization of the adaptation process, management requires its own theoretical justification and practical solution, which, in general, determines the choice of the topic of the article, forms the conceptual basis of the research and determines the scientific tools of cognition.

Scientific research and analysis in the field of creating an effective financial strategy were carried out by foreign economists, which include [1–6].

Articles [7–10] were devoted to the analysis of individual elements of the company's financial strategy.

The analysis of the scientific and expert literature shows that the formation of a financial strategy of a business entity is the subject of active study by leading economists and scientists in different countries of the world. However, at the same time, it is necessary to pay attention to the fact that the study of the influence of business environmental factors is only an integral part of scientific works and today does not fully take into account the dynamism of markets, the peculiarities of the development of economic systems, especially in the context of digital transformations and the widespread introduction of information and communication technologies.

Given the volatility of the external environment, Russian companies are forced to quickly adapt to new conditions, using different methods to ensure the use of their strategic capabilities. The need for analysis in relation to assessing the effectiveness of the implementation of the financial strategy of Russian enterprises, depending on external factors, determined the choice of the strategy, its target orientation and the complexity of the tasks solved during the study.

2. Literature Foundations

The most difficult conditions for the energy holding from the point of view of strategic management of the financial situation are the conditions of the transnational environment, characterized by a combination of powerful pressure to standardize and the tangible influence of local forces.

In the process of implementing the new paradigm of managing business entities, world practice pays considerable attention to analytical tools that allow for justifying a financial strategy using flexible technologies for its adaptation to changes in the business environment. However, the key problems of using this tool are simplified ideas about the meaning and role of strategic analysis of the business environment in the management system, the use of rather primitive methods, criteria for choosing specific methods and approaches to their application.

The essential characteristics of the place and role of the financial strategy in the strategic program and plans of the enterprise are highlighted in Table 1.

Table 1. Key content characteristics of the energy holding's financial strategy.

Characteristics	Content and Essence of the Characteristics
One of the types of functional strategy of the holding company	The functional content of the financial strategy is that it covers only one of the activities of the industrial holding and its development is part of the key functions of financial management
The most important in the complex of functional strategies of the holding	The financial strategy provides the necessary resources for the implementation of all other functional strategies, thereby ensuring the coordination and integration of the efforts of all the holding's divisions in the process of achieving the set goals and key development targets.
It covers all the financial relations of the holding and the key areas of development of its financial activities	The development and justification of the financial strategy is part of the key tasks of strategic management. A comprehensive accounting of all possible forms of financial relations of the holding, as well as the prospects for the development of its financial activities, makes it possible to ensure the growth of its market value in the long term.
Forms specific financial goals for the long-term development of the holding	Taking into account the specifics of the financial activities of the holding, the financial strategy should contribute to the implementation of the mission and the achievement of the key benchmarks of its corporate strategy, on the one hand, and on the other, without contradicting, support the implementation of the tasks of the other functional strategies.
Promotes the selection of the most effective tools and methods for achieving the financial goals of the holding	The choice is ensured by selecting and evaluating more progressive and effective ways to solve the set tasks and finding and justifying optimal financial solutions and their appropriate gradation according to the criterion of maximizing the market value of the holding
Takes into account and adequately responds to changes in the external conditions of the holding's financial activities	The modern, progressive paradigm of developing and shaping the development strategy of the energy holding determines that the fundamental content of its strategic behavior is not in the clear implementation of the tasks provided for but in the ability to respond adequately to changes in the external environment without delay, with the appropriate adjustment of the tasks set.
Provides adaptability to changes	This characteristic allows us to implement, first of all, a change in the approaches and methods of accumulating and using the financial resources of the holding. Adaptive financial potential management is an effective tool for making adjustments to the ways and forms of achieving the holding's strategic goals

Generalization of the authors' [11–17] research allows us to conclude that the strategic analysis of the business environment of market economic entities is carried out using

various methods of assessing and predicting the state of their external and internal environment, which have specific applications and are characterized by certain advantages and disadvantages.

Thus, the financial strategy is the unifying factor of the financial and strategic aspects of the management of the energy holding, which determines the financial goals for the long term and the means to achieve them.

Mathematically, the structure of the set of business environmental conditions that affect the financial strategy of a business entity can be represented as follows:

$$W(t) = \left\{ W^E(t), W^I(t) \right\} \quad (1)$$

where $W(t)$ is the general set of operating conditions; $W^E(t)$ is a subset of external operating conditions; $W^I(t)$ is a subset of internal operating conditions.

At the same time, despite the widespread practice of analyzing the business environment, insufficient attention is paid to the coverage of quantitative and qualitative methods of its implementation. In addition, for domestic business entities, one of the main problems is that the analysis of the business environment is considered as an ideology of doing business and not as a tool for strategic management. Practical experience indicates an incomplete understanding and incorrect application of business environmental analysis methods in the course of identifying market opportunities and justifying strategic priorities for the financial development of a business entity.

In the process of studying the features of assessing the state and degree of influence of the business environment on the implementation of the financial strategy of the Russian energy holding, three key problems can be identified:

- The formalization of the information necessary for the study of the business environment and the sources of its receipt;
- The specification and identification of environmental factors that affect the financial strategy;
- The selection and justification of the most flexible, appropriate and most optimal methods of analysis.

Let us consider in more detail the problem of forming an information base for assessing the state and degree of influence of the business environment on the implementation of the financial strategy of the Russian energy holding.

Based on the generalization of the information obtained from the analysis of scientific papers, it can be argued that there is a close relationship between the factors of the business environment and the energy holding, and the influence of each of them to a certain extent affects its financial strategy.

Considering the factors and conditions of the business environment that affect and determine the financial strategy of the energy holding, they can be grouped depending on the group influence with which they enter into a relationship, namely:

(1) Consumers (*Icn*);
(2) Competitors (*Icm*);
(3) Suppliers (*Is*);
(4) Intermediaries (*In*);
(5) Contact audiences (*Ica*).

Accordingly, the level of integral influence of business environmental factors on the financial strategy of the energy holding can be expressed as follows:

$$I_{BE} = f(I_{cn}, I_{cm}, I_s, I_n, I_{ca}) \quad (2)$$

The task of analyzing the macroenvironment is becoming increasingly important for the energy holding when forming its financial strategy in the context of globalization and tougher competition in international markets. This is primarily because the financial condition of any enterprise that operates in a transnational dimension and is essentially an

open system, is completely dependent on the outside world in terms of consumer demand, supply of resources, energy and personnel [18].

Within the microenvironment, it is possible to distinguish the contour of the industry and the near environment of the energy holding. The first circuit can be characterized by the actual and potential size of the industry, its development prospects and the stages of the life cycle of products and services produced, the structure of industry expenditures, the scale of competition, the logistics and sales system used, and the trends in the development of industrial production within this industry [19]. The analysis of the industry features allows for the analysis to get an idea of the effectiveness of the planned activities provided for by the financial strategy of the holding.

The formed information base forms the foundation for assessing the impact of the business environment on the financial strategy of the energy holding and, accordingly, determines the need to choose specific methods and approaches that allow for fundamental analysis, within which it is possible to identify general trends, as well as to implement applied research detailing specific manifestations, spheres and factors of influence.

Table 2 outlines an approximate, conditional list of research works and typical tasks that can take place when conducting both fundamental analysis and applied research.

Table 2. Indicative list of research works in the process of assessing the state and degree of influence of the business environment on the implementation of the financial strategy of the Russian energy holding.

Types of Research Works	Typical Tasks
Assessment of financial market parameters	- study of the structure and profitability of financial instruments; - analysis of the dynamics of inflation; - research of positions of key currencies; - investment risk analysis; - evaluation of credit offers on the market; - analysis of the Central Bank's discount rate; - study of own debt load, capital adequacy, profitability and liquidity;
Quantitative research of consumers and competitors	- analysis of price expectations; - evaluation of brand indexes of the competitive environment; - building maps of the perception of competitors; - quantitative assessment of consumer choice motives; - determining the vectors of switching consumers to competitors' offers;
Expert analysis	- assessing threats and opportunities; - determining short-term trends in the market environment;
Analysis of the product range and sales volumes	- customer base assessment; - evaluation of the economic efficiency of assortment items (ABC analysis); - assessment of sales stability (XYZ analysis).

Next, we will specify the factors of the energy holding's business environment that affect both the choice of the financial strategy and the results of its implementation.

Among the key characteristics of the external environment is the interconnectedness of factors: complexity, uncertainty, mobility. These characteristics of the external environment indicate a significant dynamic and variable nature of the changes that occur in it.

In this context, according to the author, it is necessary to take into consideration two conceptual aspects:

(1) All components of the macroenvironment of the energy holding are in a state of interaction, that is, changes in one of the components necessarily lead to changes in the other components of the macroenvironment. Therefore, their analysis should be carried out in a comprehensive manner, tracking specific changes in individual components of the environment and assessing their impact on other components;
(2) The strength of the disturbing effects of individual components of the macroenvironment on different holdings is not the same. For example, the degree and intensity of influence have different expressions and forms of manifestation, which depend on the industry and territorial affiliation of the holding, the size of the holding, and so on. For this reason, when analyzing the macroenvironment, it is necessary to use a homomorphic model with the allocation of only those parameters that significantly affect the financial strategy of an industrial holding and can be measured with greater or lesser accuracy.

According to the author, considering the peculiarities of the development of modern markets, as well as taking into account the specifics of the work of energy holdings in Russia, the factors of the external environment's influence on the financial strategy can be grouped into four aggregated categories:

- Forming factors: the factors that determine the dynamics of a financial strategy;
- Regulatory factors: factors that influence the dynamics and changes in the forming factors, which accordingly determines the regulatory impact on the financial strategy;
- The market: this group consists of factors that have a multidirectional influence, they can initiate both the emergence of opportunities and the emergence of difficulties and threats to the financial strategy;
- Warning factors: the threshold values of these factors signal that the economic system is out of dynamic equilibrium, as a result, there is the possibility of crisis phenomena.

Typical internal threats include imperfection of the organization of the financial management system; inefficiency of investment activities; non-compliance with liquidity indicators; abuse and incompetence of managers (accounting fraud, falsification of expenses, misappropriation of income, etc.); weak marketing policy; an inefficient financial monitoring system; the presence of information leakage channels; low capitalization.

Having determined the sources of information and the factors of the business environment that affect the financial strategy of the energy holding, we focused on choosing and justifying the most flexible, appropriate and optimal methods of analysis.

To study the impact of business environmental factors on the activities of business entities, in general, and their financial strategies, in particular, various methods were used, most of which are based on expert assessments and the implementation of a certain sequence of stages: the selection of the object of analysis (enterprise, structural unit, etc.), the justification of criteria and the formation of a group of experts, the development of a form for analysis and filling out questionnaires, etc., the evaluation of results and the formulation of final conclusions [20].

The theory and practice of studying the business environment and its impact on market participants have developed and proven the effectiveness of using such methods of fundamental analysis as SWOT analysis, PEST (STEP) analysis, SLEEP analysis, STEEPLE analysis, ETOM analysis, QUEST analysis, etc. [21].

The essential features of economic processes in the Russian economy are the incompleteness and fragmentary nature of the initial data, the limited information (short samples), the unidentified nature and type of relationships between the output and input variables, and the absence of a normal distribution in the static sample. These features significantly limit the use of traditional methods of analysis, in particular, the ARIMA model and other univariate extrapolation regression models, and require the development of new non-traditional approaches and methods based on artificial intelligence. Accordingly, in this case, the most acceptable is the use of methods based on the Fuzzy Logic methodology.

In turn, the diversity and uncertainty of the external and internal environment conditions determine the objective need for a timely and rapid response of the energy holding's

financial strategy management system to changes with minimal costs, so in this case, the most appropriate and effective was the use of neural network analysis technologies that allowed for not only the collection and analysis of information about the factors of the business environment, as well as to quantify and qualitatively measure them, but also to assess their overall impact on the main components of the financial strategy. Additionally, neural network control systems demonstrate high efficiency if there is no complete set of data, or in the case when a complex object is analyzed [22].

It should be noted that the boundaries between the different approaches are unclear. In addition, practice proves that the use of hybrid analysis technologies based on the combination of traditional management methods, Fuzzy Logic and Neural Network, allows for the creation of intelligent assessment and management systems that are effective in a wide range of situations.

The desire for structural knowledge of the factors that influence the business environment on the financial strategy of business entities and the need to level out uncertainty is a natural desire of any management. It was this fact that led to the emergence of a methodology for dividing the factors of influence into "hard" and "soft". The starting point of this approach is the recognition that the success or failure of a strategic decision in the financial sphere depends on the uncertainty of the initial conditions and possible changes in the conditions of its implementation under the influence of a changing environment [23].

However, a significant number of factors of the business environment are not subjected to such a precise and formalized analysis because they do not have clear and precise manifestations, are not amenable to mathematical evaluation, they are difficult to quantify, and, in addition, their impact and the consequences of such impact are unpredictable. Only predictions can be made. In this case, it is also difficult to choose the right strategic decision of the financial behavior of the business entity. This type of factor is classified as "soft". Therefore, some alternative approach is needed, which includes the absence of the answer checked by the conditions of the problem in advance [24–27].

This feature characterizes the difference between two types of opposite factors of the business environment of modern business entities (Table 3).

Table 3. Identification of "hard" and "soft" factors.

Hard Factors	Soft Factors
Unambiguous understanding of the factors and directions of their influence. The assessment, analysis and management tools are unambiguous. It is known what the factor is. You know what you need to know about it. The problem of factor influence is clearly structured.	There is no single approach to factor identification. It is not known what the influence factor and the tools of its influence are. The information that needs to be established is difficult to identify and formalize. The method of evaluation and analysis is not obvious. The clear limits of the influence of the factor are not clear.

Considering the strategic problems of managing e-holdings in the modern business environment, in the author's opinion, in most cases, the factors of its influence should be referred to as "soft". However, the question immediately arises of how to identify in time the actions (and what those actions are) to choose for a business entity in the event of the influence of "soft" factors, when it is not only impossible to build algorithms, but it is often difficult to clearly characterize the factor itself, not to mention building a sequence of actions to solve emerging problems.

In this case, the theory of fuzzy logic and fuzzy sets is indispensable, because it is one of the most promising areas of scientific research in the field of analysis, forecasting and modeling of uncertain and stochastic economic phenomena and processes [28–30].

It is obvious that after selecting specific methods and approaches of analysis, a separate refinement and formalization requires an algorithm for conducting evaluation and analytical procedures.

Let us consider the algorithm developed by the authors for assessing the state and degree of influence of the business environment on the implementation of the financial strategy of the energy holding (Figure 1).

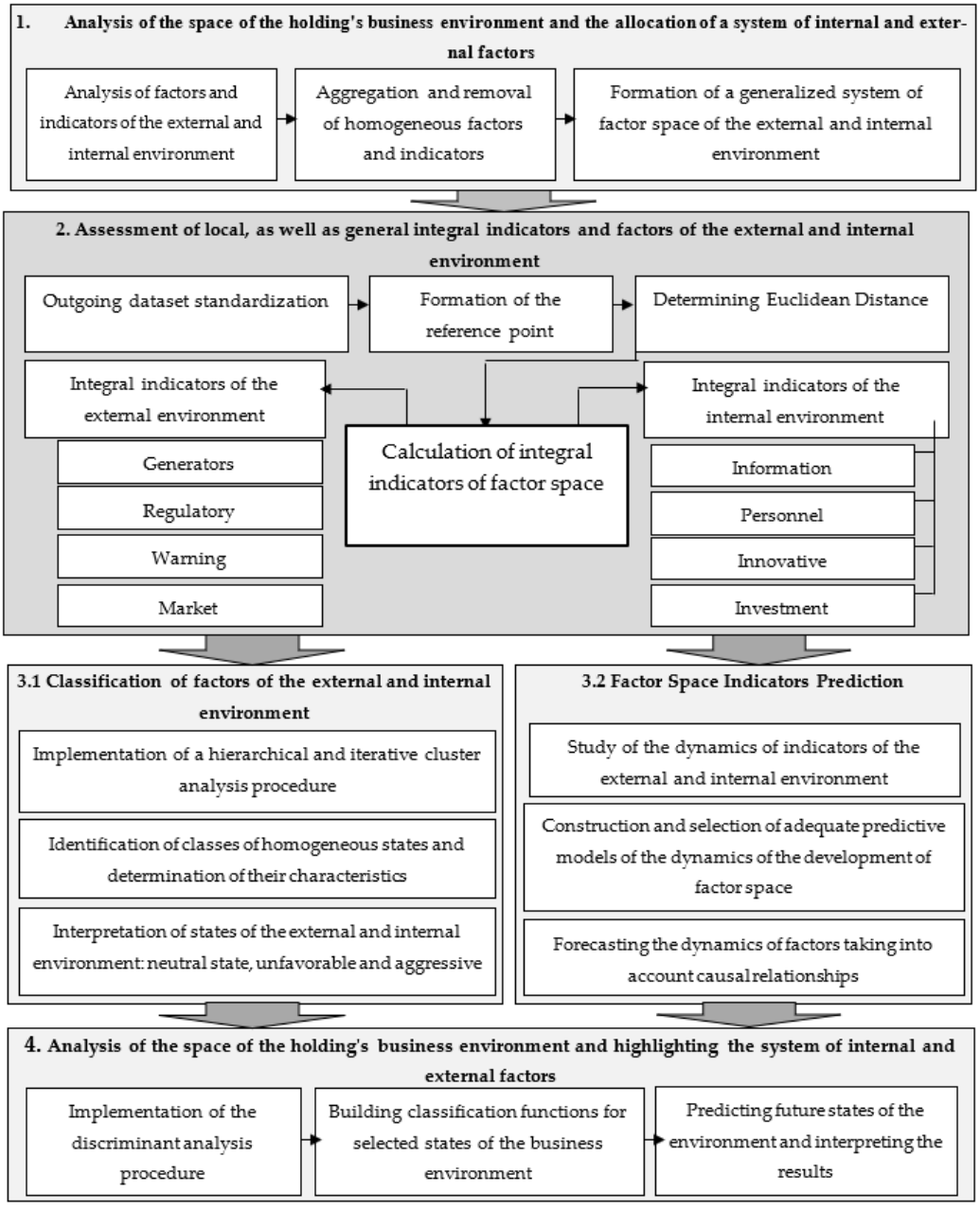

Figure 1. Algorithm for assessing the state and degree of influence of the business environment on the implementation of the financial strategy of a Russian energy holding.

Let us consider in more detail the features of using the proposed algorithm. The first step in assessing the factor space is to analyze and form a system of indicators of the external and internal business environment that affect the financial strategy of the energy holding. As mentioned earlier, when forming this system, the information base is the official publications of international organizations and rating agencies, information from public authorities, statistical reports, periodicals, official materials, etc.

The next step after the formation of the system of indicators of the factor space was the assessment of local and general integral indicators of the factors of the external and internal environment by the method of integral rating assessment.

The value of the integral indicator traditionally varies in the range from 0–1. The closer the value of the integrated assessment approaches 1, the more favorable the impact of this factor on the financial strategy of the energy holding and the results of its implementation. At the same time, it should be noted that all factors considered were divided into two groups based on the nature of the impact of each of them on the financial strategy, and depending on this, they can be stimulators and discouragers. In case of the negative influence of external and internal factors, it is important for the holding company to coordinate its activities in a timely manner, which will allow it to maintain financial stability. The positive influence of factors enables the implementation of promising areas to ensure financial stability.

At the third stage of the algorithm implementation, the classification and interpretation of the states of the factor space were carried out. To determine the types of the state of the external and internal environment, it is advisable to cluster factors using hierarchical (natural classification methods) and iterative (K—means method) methods. The obtained statistical characteristics were the basis for the interpretation of the states of the external and internal environment: neutral, unfavorable and aggressive.

Additionally, in the third stage, the indicators of the factor space of the external and internal environment of the energy holding were predicted to determine future development trends.

To predict the values of factors, according to the author, it is necessary to use the methods of dynamic econometrics, namely VAR analysis, since it takes into consideration the entire set of cause-and-effect lag relationships and is an adequate forecasting tool for several time series.

The last and fourth stage of the algorithm was the recognition of the future states of the factors of the external and internal environment, which is advisable to carry out on the basis of the use of methods of discriminant analysis and the construction of discriminant classification functions, which allowed for a forecast state of the factors to be made, and, as a result, the possible results of the implementation of the financial strategy of the energy holding.

We formalized the factors of the external and internal environment and compiled a list of information sources that allowed us to form a base for research. We conducted a critical analysis of various methods and tools for assessing the state and degree of influence of the business environment on the implementation of the financial strategy of the energy holding and considered, in practice, the features of using the recommendations, approaches and methods of action.

3. Results

Using the example of PJSC NOVATEK, using intelligent systems based on SWOT analysis and neural network modeling technologies, we assessed the state of the holding's financial strategy and determined the impact of the business environment on the results of its implementation.

First of all, we note that it is advisable to build and analyze neural network models using modern software packages that implement the appropriate technologies. Among them are the following: Neuro office, NeuroSolution, NeuroShell, STATISTICA Neural Networks, and others [31–33].

To assess the impact of business environmental factors on the financial strategy of PJSC NOVATEK, it is necessary to design neural networks and study their effectiveness in one of the above software packages.

The initial variable a of the neural network can be such indicators as the amount of profit from operating activities, the number of losses, the probability of break-even activities, the effectiveness of financial activities, the risk of liquidity and financial stability,

the index of the ratio of debt and equity, and many other economic indicators of the financial activities of the holding.

The choice of the final indicator/output variable of the neural network determines the set of input variables. Therefore, they can be summarized as follows:

$P = \{P_p\}$, $p = \overline{1,n}$ represents the set of factors of direct influence of the external environment, where the lower index $p = 1$, for example, characterizes the impact of factors initiated by suppliers, $p = 2$—financial institutions, $p = 3$—by consumers, $p = 4$—competitors, etc.

P_{pj_p}, $p = \overline{1,m}$, $j_p = \overline{1,J_p}$ represents the many factors of direct influence of the external environment of the lowest level of the hierarchy;

J_p is the number of factors of direct influence of the environment at the lowest level of the hierarchy in the p—the group of factors at the top level;

$K = \{K_k\}$, $k = \overline{1,n}$ represents a set of factors directly affecting the internal environment, where the lower index $k = 1$ characterizes the influence of factors related, for example, to the professionalism of managers, $k = 2$—the presence of financial and other restrictions, $k = 3$—risky behavior in the financial market, $k = 4$—creditworthiness, etc.

K_{kj_k}, $k = m$, $j_p = \overline{1,I_k}$ represents the many factors directly affecting the internal environment of the lowest level of the hierarchy;

I_k is the number of factors of direct influence of the internal environment of the lowest level of the hierarchy in the k-th group of factors of the upper level;

$Z_l, l = \overline{1,10}$ represents the artificial neurons of the first layer;

S represents the artificial neural network of the output layer.

For example, if a is interpreted as the probability of a successful launch by a division of PJSC NOVATEK of the development of a new field (in full, just in time), then the set of input variables is given as follows:

$P_1 = f(P_{11}, P_{12}, P_{13})$, where P_{11} is the price for the supply of spare parts for vehicles; P_{12} is the price of equipment and mechanisms; P_{13} is the terms of delivery of necessary consumables and the renewal of fixed assets of production;

$P_2 = f(P_{21}, P_{22})$ where, P_{21} is the salary of service personnel, P_{22} is the working conditions;

$P_3 = f(P_{31}, P_{32}, P_{33}, P_{34})$, where P_{31} is the type and brand of extracted natural resources; P_{32} is the terms of delivery to customers; P_{33} is the distance and difficulty of the route, P_{34} is the demand for products;

$P_4 = f(P_{41}, P_{42}, P_{43})$, where P_{41} is the demand for competitors' products; P_{42} is the competitiveness of the holding company; P_{43} is the prices for a similar type of product from competitors;

$P_5 = f(P_{51}, P_{52})$, where P_{51} is the tightening of customs legislation; P_{52} is the tax burden on this type of operation;

$K_1 = f(K_{11}, K_{12})$, where K_{11} is the qualification of senior managers, K_{12} is the organization of financial management, requirements for continuous training and development of new analysis technologies;

$K_2 = f(K_{21}, K_{22}, K_{23})$, where K_{21} is the presence of financial encumbrances on the property, K_{22} is the availability of outstanding loans, K_{23} is the presence of overdue debt;

$K_3 = f(K_{31}, K_{32})$, where K_{31} is the purchase of risky securities, K_{32} is investment in risky projects with an indefinite payback period.

All levels of the selected influence factors can be changed both quantitatively and qualitatively. For this purpose, it is necessary to define a linguistic variable "Level of parameter X", the carrier of which is a certain region of parameter X, and the term-set of values forms fuzzy subsets "very low level", "low level", "medium level", "high level", "very high level" [34–36].

Thus, an increase in the strength of the influence of one qualitative factor is accompanied by a corresponding decrease in the influence of the neighboring factor. At the point $\mu = 0.5$, the maximum degree of information uncertainty is reached, that is, in it, all neighboring qualitative characteristics have the same strength (identical). In the middle of

the upper faces of the trapezoids of the classifier, there are nodal points that can be used as a system of weights in the process of aggregating vaguely defined data [37,38].

In practice, to analyze the impact of factors of the external business environment of PJSC NOVATEK on its financial strategy, the use of fuzzy set tools can have the following form.

Let us assume that the base factor (suppliers of equipment and spare parts), the influence of which is analyzed, has three component characteristics (pricing policy; reliability; image) with a weight of 0.6, 0.3 and 0.1, respectively. The level of each of them is estimated by the expert at 0.2, 0.6 and 0.5, respectively.

The functions of the membership of the carrier X to the corresponding fuzzy subset has the following form:

High factor level:

$$(X) = \begin{cases} 0,\ 0 \le X < 0.55 \\ 10(X - 0.55),\ 0.55 \le X < 0.65 \\ 1,\ 0.65 \le X < 0.75 \\ 10(0.85 - X),\ 0.75 \le X < 0.85 \\ 0,\ 0.85 \le X < 1 \end{cases}$$

Average factor level:

$$\mu(X) = \begin{cases} 0,\ 0 \le X < 0.35 \\ 10(X - 0.35),\ 0.35 \le X < 0.45 \\ 1,\ 0.45 \le X < 0.55 \\ 10(0.65 - X), 0.55 \le X < 0.65 \\ 0,\ 0.65 \le X < 1 \end{cases}$$

Low factor level:

$$\mu(X) = \begin{cases} 0,\ 0 \le X < 0.15 \\ 10(X - 0.15),\ 0.15 \le X < 0.25 \\ 1,\ 0.25 \le X < 0.35 \\ 10(0.45 - X), 0.35 \le X < 0.45 \\ 0,\ 0.45 \le X < 1 \end{cases}$$

Feature level recognition detects that the first one has a probability of 0.5 low or very low; the second one is unambiguously high; the third one has a probability of 0.5 medium or high. In order to assess the strength of the influence of the "suppliers" factor on the financial strategy of the holding, we constructed a matrix that made it possible to calculate the intensity of the impact of each of its characteristics separately (Table 4).

Table 4. Matrix required for conducting an integral assessment of the impact of the "suppliers" factor on the financial strategy of PJSC NOVATEK».

Factors	Weight Characteristics	Accessory Functions				
		Very Low	Low	Average	High	Very High
Pricing policy	0.6	0.5	0.5	0	0	0
Reliability	0.3	0	0	0	1	0
Image	0.1	0	0	0.5	0.5	0
Nodal points		0.075	0.3	0.5	0.7	0.925

In this case, the theory of fuzzy logic and fuzzy sets is indispensable because it is one of the most promising areas of scientific research in the field of analysis, forecasting and the modeling of uncertain and stochastic economic phenomena and processes [39].

Thus, the calculation based on the data in Table 4 looks like this:

$$SW = 0.6 \times (0.5 \times 0.75 + 0.5 \times 0.3) + 0.3 \times 1 \times 0.7 + 0.1 \times (0.5 \times 0.5 + 0.5 \times 0.7) \quad (3)$$

The calculation shows that the influence of the "suppliers" factor on the financial strategy of PJSC NOVATEK is determined by 80% as average and 20% as high. Similarly, matrix folding can be performed when switching from individual indicators of the strength/weakness of the influence of a certain factor of the holding's business environment to an integral indicator. To do this, the weight of the basic factors in the integral needs to be determined.

Furthermore, according to the authors, a significant interest in the process of assessing the state and degree of influence of the business environment on the implementation of the financial strategy of an industrial holding using intelligent technologies is the procedure for selecting a specific type of strategy, depending on the capabilities, resources, limitations, advantages and potential of the holding itself, i.e., on the characteristics of its internal environment.

Using neural network calculations, we assessed how the advantages and disadvantages of the internal organization of PJSC NOVATEK affected the choice of its financial strategy.

The holding company is faced with the task of choosing one alternative out of four possible options for financial strategies:

(1) The strategy of financial support for Accelerated Growth (A1);
(2) Strategy for Financial Support of Limited Growth (A2);
(3) Financial Security Support Strategy (A3);
(4) Individual Production Support Strategy (A4).

Each of these strategies has certain characteristics.

Strategy A1—it is focused on taking a leading position in the market. This goal can be achieved when the holding company has some advantage over its competitors and also has the potential to reduce the cost of production. At the same time, the implementation of this strategy provokes the emergence of price competition.

Strategy A2—the goal of this strategy is to increase the specialization and concentration of the holding's activities to meet the requirements of a specific segment of consumers. This strategy assumes the need for additional financial investments, but at the same time, it will take a leading place in technological development.

The A3 strategy does not provide for any radical changes; it is aimed at maintaining a stable financial position of the holding.

The A4 strategy requires additional investments directed to the readjustment of production lines, which will expand the product range. The implementation of this strategy allows for expanding the circle of consumers and contributing to the redistribution of the market between the participants.

To evaluate alternatives, we used the following criteria: C1, production costs; C2, sales costs; C3, costs of marketing activities and research; C4, product quality; C5, the availability of free cash from the holding; C6, the state of the market and the holding's position on it; C7, the risk of unpredictable losses.

The relative humidity was estimated using a linguistic variable.

W = {very important; important; important enough; not very important, practically not important}. The values of the reduced terms of the set were given by fuzzy numbers with a triangular form of membership functions.

The criteria were assigned the following linguistic ratings of relative importance: a = {a4 = not important; a3 = sufficiently important; a2 = important; a1 = very important}.

To evaluate alternatives by criteria, we used the linguistic variable S = "satisfaction" = {very low; low; medium; high; very high}. Figure 2 shows the membership functions of terms that have the form of triangles:

- extremely low = {1.0/0.0; 0.0/0.0};
- low = {0.0/0.0; 1.0/0.2; 0.0/0.4};

- average = {0.0/0.3; 1.0/0.5; 0.0/0.7};
- high = {0.0/0.6; 1.0/0.8; 0.0/1.0};
- very high = {0.0/0.8; 1.0/1.0}.

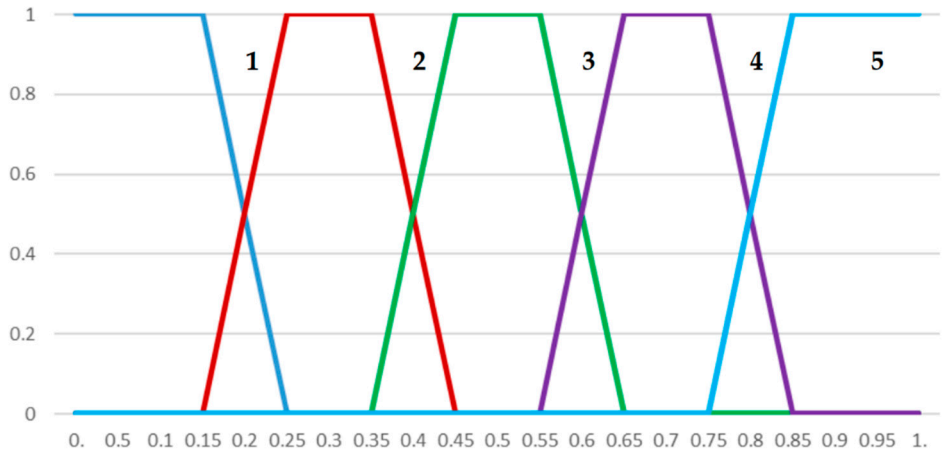

Figure 2. Membership functions for criteria importance terms. 1—extremely low, 2—low, 3—medium, 4—high, 5—very high.

Table 5 shows the grouped estimates of the selected alternatives obtained as a result of a survey of the heads of various divisions of PJSC NOVATEK.

Table 5. Evaluation of the quality of alternatives according to the selected criteria.

Criteria	Evaluating Alternatives			
	A1	**A2**	**A3**	**A4**
C1	very high	high	average	average
C2	very high	high	average	average
C3	very high	average	average	average
C4	high	high	average	low
C5	average	average	very high	average
C6	high	high	low	low
C7	very high	high	low	low

We calculated the weighted estimate of the j-th alternative by the formula:

$$R_j = \sum_{i=1}^{n} \alpha_j R_{ij}$$

where R_{ij} is a fuzzy number that represents the evaluation of the j-th alternative by the i-th criterion; α_j is the normalized coefficient.

The estimates for each strategy are presented in Table 6.

Table 6. Calculation of weighted estimates for each alternative.

Criteria	The Importance of the Criterion	A1		A2		A3		A4	
		Estimation	Weighted	Estimation	Weighted	Estimation	Weighted	Estimation	Weighted
C1	0.7	0.9	0.63	0.8	0.67	0.5	0.35	0.5	0.35
C2	0.5	0.9	0.43	0.8	0.43	0.5	0.41	0.5	0.41
C3	0.2	0.9	0.34	0.7	0.57	0.5	0.27	0.3	0.54
C4	0.7	0.8	0.2	0.5	0.37	0.6	0.56	0.6	0.28
C5	0.2	0.5	0.23	0.6	0.29	0.9	0.25	0.4	0.33
C6	0.5	0.8	0.67	0.8	0.64	0.2	0.64	0.5	0.46
C7	0.2	0.9	0.54	0.7	0.67	0.3	0.78	0.4	0.41
Weighted estimates Rj			2.95		2.68		1.47		1.18

Divide the resulting Rj by the maximum value. The generalizing criterion of the membership function (additive convolution μJ (j)) gives the following result: μJ (j) = {1.00/A1; 0.908/A2; 0.498/A3 0.4/A4}, which allows us to consider the strategy of taking a leading position in the A1 market as the best alternative.

The most acceptable strategy is A1, which assumes a leading position in the market and, accordingly, the choice of promising areas of activity.

In the process of choosing a financial strategy, the task is to choose one division from the available alternatives-NOVATEK-Kostroma (A1), NOVATEK-energo (A2), Arktikgaz (A3), Rostok LNG (A4).

To assess the creditworthiness of the borrowing units, we used their reporting data. Based on these data, we calculated the following credit ratios: absolute liquidity ratio (K1), intermediate coverage ratio (K2), total coverage ratio (K3), financial independence ratio (K4) and product profitability ratio (K5). The calculation results are shown in Table 7.

Table 7. Regulatory and actual levels of credit quality criteria for the divisions of PJSC NOVATEK».

Criteria	The Value of the Criterion for the Division				Normative Value
	A1	A2	A3	A4	
K1	0.964	1.133	1.128	1.265	0.1–0.25
K2	2.842	3.467	3.662	3.584	0.5–1.0
K3	3.57	4.3	4.608	4.368	1.0–2.5
K4	0.628	0.577	0.721	0.526	0.6
K5	0.157	0.167	0.17	0.156	The more, the better

An analysis of the regulatory and actual levels of criteria shows that all divisions can qualify for funding.

Sensitivity Analysis of the Model Using the Membership Function

The advantages of each division can be determined by constructing membership functions. We constructed membership functions that correspond to the concepts of "the most preferred absolute liquidity ratio", "the desired intermediate coverage ratio", "the best profitability ratio", etc.

We will determine the specific values of the membership functions according to the quality criteria K1, K2, K3, K4 and K5.

The fuzzy sets for the five criteria have the following form:

$$\mu K1(a) = 0.64 \div 0.964 + 0.66 \div 1.133 + 0.68 \div 1.128 + 088 \div 1.265$$

$$\mu K2(a) = 1.0 \div 2.842 + 1.0 \div 3.467 + 1.0 \div 3.662 + 1.0 \div 3.584$$

$$\mu K3(a) = 1.0 \div 3.57 + 1.0 \div 4.3 + 1.0 \div 4.608 + 1.0 \div 4.368$$

$$\mu K4(a) = 0.8 \div 0.628 + 0.74 \div 0.577 + 0.96 \div 0.72 + 0.71 \div 0.526$$

$$\mu K5(a) = 0.51 \div 0.157 + 0.58 \div 0.166 + 0.68 \div 0.17 + 0.53 \div 0.156$$

Let us perform a convolution of the received information. The set of optimal alternatives *C* is located at the intersection point of fuzzy sets that contain estimates of the selected alternatives according to the selection criteria. The operation of the intersection of fuzzy sets corresponds to the choice of the minimum value for the *j*-th alternative:

$$\mu_C(a_j) = min\mu_{K_i}(a_j)$$

The optimal alternative is the one that has the maximum value of the membership function for set C.

For the situation under study, the set of optimal alternatives is formed as follows:

C = {min {0.64; 1.0; 1.0; 0.8; 0.51}

min {0.66; 1.0; 1.0; 0.74; 0.58}

min {0.68; 1.0; 1.0; 0.96; 0.68}

min {0.88; 1.0; 1.0; 0.71; 0.53}}

The obtained data allow us to conclude that the optimal alternative is a3, which corresponds to a maximum value of 0.68. The second, third and fourth places are occupied by alternatives a2 → 0.58, a4 → 0.53 and 1 → 0.51, respectively. Most of the financial resources of the funds should be provided to the division of Arktikgaz.

Thus, the conducted neural network modeling allowed, taking into account the influence of factors of the internal business environment of PJSC NOVATEK, to choose the best financial strategy according to the specified criteria, which is focused on occupying the leading position of the holding in the market and, in addition, to justify the choice of a specific division, the development of which should be emphasized in the process of implementing the chosen strategy.

4. Discussion

Considering the above, the article structures a model of the mechanism of the relationship of factors of the business environment of an industrial holding, which allows us to establish that the key elements and conditions of the business environment that affect and determine its financial strategy can be classified depending on the influence groups with which the holding enters into relationships, namely, consumers, competitors, suppliers, intermediaries and contact audiences.

In addition, guided by the developed model, the author has identified a list of data necessary for analyzing the factors of the global macroenvironment and microenvironment of an industrial holding, as well as sources of information, which will allow the creation and maintenance of an up-to-date information system for monitoring the business environment. In addition, a conditional list of research work and typical tasks has been compiled that can be carried out in the process of conducting both fundamental analysis and applied research necessary to assess the environment of an industrial holding and identify key trends in its changes and areas of influence.

A critical analysis of the methods and tools for assessing the business environment directly allowed us to state a number of shortcomings and problems of using traditional approaches and methods in the context of globalization and the dynamic interaction of an industrial holding with its environment. In this regard, the expediency of using intelligent systems based on traditional methods and neural network modeling technologies is substantiated in the work.

The use of fuzzy set theory makes it possible to overcome the disadvantages of probabilistic and minimax approaches [40,41], as well as to coordinate various management decisions in the presence of fuzzy goals, constraints, coefficients and initial conditions. The approach used in the work to assess the state of the external business environment of PJSC NOVATEK is characterized by the function of belonging to the corresponding fuzzy number, which allowed us to form a full range of possible scenarios for the state of the holding. The advantage of combining a fuzzy output system with an analytical

evaluation system is the possibility of using a single information space: source data for a fuzzy description and visualization results in the form of diagrams and data tables.

Moreover, using neural network computing, the work assessed how the advantages and disadvantages of the internal organization of PJSC NOVATEK affect the choice of its financial strategy. A significant advantage of the developed fuzzy model in comparison with known models is that the relationship between the input data and the output parameter is described using natural language concepts, which are objectively much "closer" to expert analysts than abstract mathematical concepts. This ensures a high level of adequacy of the formalization of expert knowledge about the impact of the indicators of the internal organization of the holding on its financial strategy.

5. Conclusions

Approbation of the use of fuzzy sets and SWOT analysis tools for the analysis of the external business environment was carried out on the example of PJSC NOVATEK.

To assess the state and degree of influence of the business environment on the implementation of the financial strategy of the Russian industrial holding, an algorithm was developed in the course of the study that enabled us to obtain an integral assessment of the impact of external and internal factors of the business environment of the industrial holding using taxonomy methods, multidimensional statistical analysis, cluster and discriminant models. The result of applying this algorithm in practice are econometric dynamic models of the causal interaction of factors of the external and internal environment, which make it possible to make a reasonable forecast of the financial condition of the holding and determine strategies for its further development.

Based on the obtained research results, this paper identifies the key factors of the internal and external business environment of an industrial holding that form the opportunities and threats of its effective development through the prism of the implementation of a financial strategy. In the system of factors of the external business environment, a group of formative factors, regulatory and warning factors are identified, which make it possible to assess the external competitive environment of an industrial holding and the economic situation in the country as a whole. The system of factors of the internal environment includes a group of information, investment, personnel and innovation factors, a comparative analysis of which will determine the internal reserves for the implementation of the financial strategy, as well as the possibilities of ensuring the stability and stability of the functioning of the industrial holding as a whole.

The perspective of the research is the development of a system of sub-indices for making important decisions on key areas of development of the energy holding. To do this, subordination will be introduced into the system of factors in the form of the formation of priority cereals and the aggregation of several indicators into one group. Based on the solution of such a question, the question of the optimal distribution of investments among the companies (divisions) of the holding will be raised. The economic effect will be a further increase in the holding's profit.

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