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Innovative Approaches to Assessing the Competitiveness of Business Structures Using the Method of Analysis of Hierarchies in Multi-Criteria Ranking

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Abstract - **The primary objective of this paper is the practical testing of a multi-criteria rating methodology for assessing the competitiveness of business structures. This aims to evaluate critical functional areas of their operations and justify specific managerial decisions to ensure sustainable competitiveness. Maintaining the competitiveness of business structures becomes a primary task in the context of high uncertainty and competition, as well as the presence of crises and politico-economic problems. To achieve the set objective, the Analytic Hierarchy Process (AHP), developed by T. Saaty, was utilized. This practical method allows for multi-criteria comparisons using expert evaluations and calculations of eigenvectors and values, providing systematization and quantitative assessment of criteria and alternatives' priorities. AHP includes procedures for synthesizing multiple judgments and obtaining priorities, allowing for consideration of the 'human factor' in decision-making preparation. The study results demonstrate that the multi-criteria approach to rating the competitiveness of business structures effectively accounts for all areas of their activities and forms an adequate comprehensive measure of competitiveness. Within the study's framework, three business structures with different performance trends were analyzed. The comparative importance of criteria and sub-criteria for competitiveness assessment was determined using the Analytic Hierarchy Process, considering the specifics of the business structures and their business activities. The proposed methodology for multi-criteria rating of business structures' competitiveness allows for a comprehensive assessment of their activities and justification of specific managerial decisions to ensure sustainable competitiveness. The use of the Analytic Hierarchy Process helps to consider the influence of various factors and conditions, contributing to a more objective assessment and strategic decision-making. The application of the proposed methodology is universal and can be effectively used in various sectors of business structures' activities, showcasing its adaptability.**

Keywords: **Competitiveness, Business Structures, Analytic Hierarchy Process, Multi-criteria Approach, Managerial Decisions, Sustainable Competitiveness**

I. INTRODUCTION

In the conditions of a high level of uncertainty, competition, the presence of various types of crisis phenomena, the presence of various political and economic problems in the country, ensuring the sustainable competitiveness of business structures is the primary direction of solving these problems (Oleksandr et al., 2024). The need to ensure a high level of competitiveness and improve the management of the business structure consists not only in the formation of new goals, tasks and principles of management, in satisfying the needs of consumers and expanding the market opportunities of business, but also in the prompt, timely adoption of management decisions as a response to the negative impact of external factors and internal environment (Obeidat & Yaqbeh, 2023).

With globalization creating increasingly complex and challenging market arenas—the essence of competition—businesses must do more than survive (Fernando et al., 2024). They need to win. Therefore, the question is, '*Can an assessment methodology help to better understand the interactions between performance measures and competitive outcomes?'* In other words, can analytical tools be applied to better describe how different performance aspects interact to influence the result?

This article presents a novel application of the Analytical Hierarchy Process (AHP) as a tool for determining organizational structure competitiveness. The AHP is a multi-criteria decision-making methodology that can aid an organization in making well-informed decisions by decomposing potential options onto a hierarchy of criteria and sub-criteria. A structured AHP model provides a framework for decision-makers to arrive at their preferred option among organizational structures when the decision is influenced by multiple factors (market share, client satisfaction, internal operations efficiency, and financials). The uniqueness of using AHP in competitive advantage assessment is that it can combine qualitative and quantitative data altogether to provide a well-rounded picture of the performance of an organization. After making decisions with the AHP, companies can improve their strategic decision-making, ensuring their plans will be better in achieving overall corporate goals. Also, when technology, trends, and consumer behavior are transforming the market landscape, organizations should be flexible to keep up with the changing climate.

Our research aims to showcase not only the value of AHP in facilitating intelligent decision-making processes but also the improvement in organizational resilience in case of market reversals. The purpose of the article is the practical approbation of the methodology of multi-criteria rating of the competitiveness of business structures in order to evaluate the key functional areas of their activity and justify specific management decisions to ensure sustainable competitiveness (Sundara Bala Murugan et al., 2024). To accomplish these objectives, this article will provide the theoretical framework underlying AHP, demonstrate the practical applications of the approach, and highlight the implications for business leaders embarking on trips to new frontiers in search of newfound competitive advantage (Nehme et al., 2024).

II. Theoretical Background

The issue of competitiveness of business structures and methodical approaches to its assessment were studied by such scientists as (Voronkova, 2000; Kuzmin, 2011; Yalcin et al., 2022), and others. In their works the issues of analysis of competitive advantages and determination of the competitive position of the business structure on the market, assessment and directions for increasing its competitiveness are considered (Iryna et al., 2024). However, the issues of development of a system of indicators and components of a competitive strategy of a business structure, adaptation of methodological approaches to their practical application in modern conditions of business activities remain unresolved (Sánchez-Ancajima et al., 2022).

According to the studies of (Mayer, 2021; Edmans, 2021), the purpose of business is to make a profit by satisfying individual and collective needs in goods, works and services. Modern business structures must have a significant resource base for successful interaction with other business entities and timely provision of a dynamic competitive advantage (Bari et al., 2022). Their development is considered effective when resources are directed to those areas where they can provide maximum competitiveness for a long period (Baros, 2020). This is achieved due to external and internal factors.

To reflect the current specifics of industrial relations in the business environment, the term '*business structure*' was introduced. Business structure is a system of economic, social, political and spiritual relations related to the satisfaction of the set of needs of owners and employees through interaction with the external environment, based on the interconnection of the development process with the creation of new combinations of production factors, new products, markets, technologies (Kochubey, 2012). Business structures should be characterized as a system object possessing such properties as integrity, hierarchy and integrability.

Business structures have the following main features: (i) instability of individual parameters and stochasticity of behavior caused by objectively existing disagreements and conflicting interests of various components of the system; (ii) the unpredictability of behavior in specific conditions, which is associated with the influence of random factors, the divergence of interests of economic subjects and subjects of management at different levels, the unreliability of information about the state of the external and internal environments; (iii) ability and desire for goal formation (Podvalny et al., 2021). Goals can be both set from the outside and formed within the system. It should be noted that the goals of subsystems of the business structure do not coincide with the goals of the system as a whole but must be subordinated to them; (iv) the ability to adapt to changing conditions of internal and external environments, which has both positive effects and negative consequences (Kryvenko & Kryvenko, 2014).

In the conditions of the modern market, business structures act as open, non-linear and non-equilibrium economic systems, the components of which are capable of self-organization. It is the internal environment and the processes that take place in it that form the basis of its functioning, development and self-organization (Andrushkiv, 2010).

The effectiveness of business structures largely depends on the speed of reaction to economic changes and the implementation of preventive measures to reduce its instability (Wenzel et al., 2020). The advantage of forming an effective system of organization of business structures is manifested in the emergence of a synergistic effect due to the systemic properties of the new structure, increasing the

efficiency of the use of available resources, as a result of which prerequisites are created for the sustainable development of the national economy.

The competitiveness of business structures is formed by the competitiveness of the idea, products, production system, and the system of sales of products (goods and services). Those business structures that can implement the strategy of transforming sources of competitive advantages due to the innovative development of potential, producing and selling products that are in demand, and making a profit in market conditions should be considered competitive (Drucker, 2007).

The competitive advantage of the business structure is determined by a combination of intra-system, systemic and extra-system factors (Lin & Hu, 2020). Each of the specified aggregates is significant for gaining a competitive advantage of the business structure and its competitiveness. At the same time, competitive advantage is determined by specific factors, their structure, proportions, as well as the conditions for the creation and development of business structures, their improvement and degree of development (Distanont, 2020). Also, one of the factors that ensure an increase in the competitiveness of business structures is the innovative activity of specialists as the main intellectual and creative resource that ensures the development, implementation and market entry of innovative business structures (Mysachenko et al., 2020). Thus, depending on the factors used to increase the competitive status, the main directions for increasing its competitiveness should be determined.

In order to achieve a high level of competitiveness, business structures should base their activities on the following principles: systematicity, comprehensive assessment of factors of functional orientation, consideration of the specifics of the production of goods (providing services), hierarchical indicators, information support, comparability, continuity (Lohosha, 2022). Among the above-mentioned principles, according to (Cinelli et al., 2020), the principle of comprehensive assessment of factors, which involves a comprehensive analysis of their composition and mechanism of influence, is the most important. The course of further analytical and practical activities depends on this. The use of these principles allows to form a scientifically based system for assessing the level of competitiveness of business structures.

Among the strategic guidelines of the management system of business structures, the following should be highlighted:

a. Reengineering, i.e., reconstruction on a modern informational and technological basis of the organization of production and management, within the framework of which new impulses to increase efficiency are considered, related to the reduction of sizes and optimization of economic entities. The management mechanism is adjusted to mastering the market, for which an analysis of its capacity, the organization of sales of goods, methods of stimulating sales, and ensuring the competitiveness of goods and services is carried out.

b. The laws and principles of the market economy are transferred to the internal activities of business structures. Such transformations should cover all divisions—linear, functional, marketing, and management apparatus.

c. The use of the associative forms of organization and management theory.

Integration processes in management, focused on more efficient use of all types of resources, cause the appearance of various forms of business structures (Amosha et al., 2011).

The real possibilities of achieving the goals of business structures, their effective operation largely depend on the system of making strategic management decisions (Fuertes et al., 2020). Such a system can be considered as a set of three components—an organizational and administrative mechanism that determines the order of initiation, preparation, discussion and decision-making in business structures; interest accounting systems in the process of preparation and decision-making; information support of the decision-making process.

In the field of business structures, non-standard strategic solutions that allow reconciling conflicting economic interests of business entities and initiating the action of economic mechanisms that do not work are of great importance (Pulignano et al., 2020). An innovative type of management solutions is decisive for the successful operation of business structures and ensuring their competitiveness.

The competitiveness of the business structure is noted by us as a generalizing evaluation indicator of the level of efficiency of the use of resources and activities of all units, based on which the ability of the business structure to generate management decisions regarding adequate response to changes in the external and internal environments and ensuring a stable competitive position on the business market is determined (Karpenko, 2013).

The competitiveness of the business structure depends on certain factors: market capacity, ease of market access, industry competitiveness, the possibility of technical news in the industry, market homogeneity, regional and country competitiveness (Markina et al., 2010). For the successful functioning of any business structure on the market, it is necessary to regularly assess its competitiveness. Such an assessment makes it possible to determine the strengths and weaknesses of the business structure, to reveal its hidden potential and, accordingly, to maximally improve its operation strategy (Kondratiuk, 2011).

The assessment of the competitiveness of the business structure consists in the calculation, interpretation and

evaluation of a set of indicators characterizing the state of the market environment and various aspects of the business structure's activity, which form its competitiveness. One of the main problematic points in assessing the competitiveness of business structures is the difficulty of choosing a system of criteria and indicators, according to which the assessment will be carried out.

In scientific publications of (Drobitko, 2001; Fatkhutdinov, 2005a, b; Oberemchuk, 1999; Nemtsov & Dovgan, 2001; Burkinsky, 2002), for the most part, among the main directions of assessing the competitiveness of business structures, we distinguish the assessment of competitiveness based on the results of economic activity, the factor approach to the analysis of competitiveness, the influence of the strategy of a business structure on its competitiveness. Economic potential and efficiency of activity are distinguished as leading indicators, management level, market activity, production and sales potentials, research potential, financial position, the company's reputation, the state and qualification of labor resources, combining them into groups of indicators of the efficiency of production activity of the business structure, financial condition, efficiency of the organization of sales and product promotion, competitiveness of the product and efficiency of innovative activity, etc. (Berezina et al., 2021; Burachek & Bilenchuk, 2016; Grosul, 2010; Smolin, 2006; Balan & Anisimova, 2011).

The rating of the competitiveness of the business structure requires complexity and multidimensionality in order to take into account the effectiveness of all areas of their functioning and to form an adequate generalizing measure of competitiveness—the rating. Under such conditions, a multi-criteria approach to the rating assessment of the competitiveness of business structures becomes extremely important.

III. METHODOLOGY

The analysis of literary sources made it possible to distinguish two groups of methods that are used to diagnose the competitiveness of business structures:

a. *Partial:* methods that involve diagnosing the competitiveness of a business structure based on the assessment of one or more components of functioning.
b. *Complex:* methods aimed at the simultaneous assessment of the maximum range of spheres and links of the functioning of the business structure (Kuzmin, 2011).

Based on the analysis of shortcomings and debatable provisions in the field of modern instrumental provision of rating of business structures, we consider the use of the method of analysis of hierarchies (MAI) proposed by T. Saati to be the most adequate within the framework of multi-criteria rating (Saati, 1993).

MAI remains a fairly popular approach to solving multicriteria problems. This is because one of its main advantages over other decision-making methods is that it allows you to take into account the "human factor" when preparing a decision. The structure of the decision-making model is a reproduction of the real situation in the subject area, reflects the preferences of the person making the decision. Within the framework of the method of analysis of hierarchies, there are no general rules for forming the structure of the decision-making model. The method allows us to take this circumstance into account by harmonizing different opinions by determining their priorities.

Analyzing hierarchies allows you to break down an enormous task into several small independent tasks. Thanks to this, it is possible to involve experts who work independently of each other on local tasks to prepare a decision. Experts may need to learn about the nature of the decision, which partially helps preserve the objectivity of the obtained estimates and data. In particular, thanks to this, it is possible to keep secret the information about preparing the decision.

The scheme of application of the method is absolutely independent of the field of activity in which the decision is made. Therefore, the method is universal, its application allows organizing a decision support system.

The method of analyzing hierarchies makes it possible to obtain effective assessments of socio-economic processes characterized by a multitude of versatile factors that require preliminary structuring, and quantitative indicators characterizing the manifestations of these factors are often absent. In this case, their qualitative assessment proposed by experts is used.

The method is a decomposition of the problem into simple component parts and further processing of a sequence of judgments based on pairwise comparisons. MAI includes procedures for synthesizing multiple judgments, obtaining the priority of criteria and finding alternative solutions. The values obtained in this way are estimates according to a special scale of relativity (Andreichikov & Andreichikov, 2000).

In MAI, pairwise comparisons at each level of the hierarchy are very important: the elements of the task are compared in pairs regarding their influence (intensity) on the characteristic common to them. The results of pairwise comparisons are placed in matrix form. Eigenvectors and eigenvalues are defined for the matrix. To calculate the eigenvectors, you can use the geometric mean method (Igumnov & Zavhorodnyaya, 2000). First, the estimates of the components of the eigenvector are calculated by rows, and then the obtained result is normalized to obtain the estimate of the priority vector. After that, the degree of importance of each element can be estimated as a result of multiplying the matrix by the priority vector. Such calculations provide a way to quantify the comparative importance of factors or outcomes in a problem situation.

After forming a set of local priorities, they are synthesized, starting from the second level down.

Framework for Multi-Criteria Ranking of Business Structure Competitiveness Using Hierarchical Analysis

We will conduct a practical test of the multicriteria rating of the competitiveness of business structures using the appropriate methodology developed in our authorship, according to which the system of criteria for evaluating the competitiveness of business structures covers such areas of activity as marketing, management, production, finance, with the specification of evaluation indicators and their reliable information support. The introduction of multi-criteria ranking of competitiveness will allow to evaluate the key functional areas of the business structure and justify specific management decisions to ensure its sustainable competitiveness.

By using the methodology of the method of analysis of hierarchies, we will solve the problem of multi-criteria ranking of the competitiveness of business structures based on three business structures with different trends regarding the efficiency of activities with the following characteristics:

- *Business structure A:* A profitable business structure with a trend of increasing activity efficiency over the period under analysis.
- *Business structure B:* A business structure with an unstable financial result and a changing trend of activity efficiency.
- *Business structure C:* Unprofitable business structure with a tendency to decrease the efficiency of activity.

To solve the problem of multi-criteria ranking of the competitiveness of business structures, the method of analysis of hierarchies allows to quantitatively determine the comparative importance of criteria and sub-criteria for assessing competitiveness, and also takes into account the specificity of business structures and their business activity. The method involves conducting pairwise comparisons of criteria and subcriteria using subjective judgments numerically evaluated on a defined scale. It is advisable to use the criteria with the greatest values of importance when developing a strategy of competitive behavior.

Representation of the problem in the form of a hierarchy: We define criteria for each direction of competitive activity of the business structure: marketing, management, production, finance. We select subcriteria for each criterion.

1. Sub-criteria of the "marketing" criterion: product policy, price policy, distribution policy.
2. Sub-criteria of the "management" criterion: level of work organization, level of staff utilization, management innovations.
3. Sub-criteria of the "production" criterion: level of exploitation of technical resources, economy of production costs, supply of material resources, supply of circulating stocks.
4. Sub-criteria of the "finances" criterion: property status, liquidity and solvency, financial stability, turnover of capital, profitability of capital.

The task of multi-criteria ranking of the competitiveness of business structures is to find the business structure that is the most competitive according to the selected criteria and sub-criteria. That is, the task has been set—to assess the level of competitiveness of each business structure and transfer this data to the general population (a group of business structures).
For this, the task must be presented in a hierarchical form. At the first (higher) level, the general goal of "Competitiveness of the business structure" is established. On the second level—criteria (directions of competitive activity of a business structure), on the third level—subcriteria (signs of grouping indicators of the level of competitiveness of business structures), on the fourth level are placed business structures that must be evaluated in relation to the subcriteria of the third level of the criteria of the second equal.

The hierarchical model of multi-criteria rating of the competitiveness of business structures is shown in Figure 1. The form of descending decomposition covers a large class of problems; and the hierarchy of levels should be such that the elements of the lower level are compared pairwise with respect to the elements of the next level and so on to the top of the hierarchy.

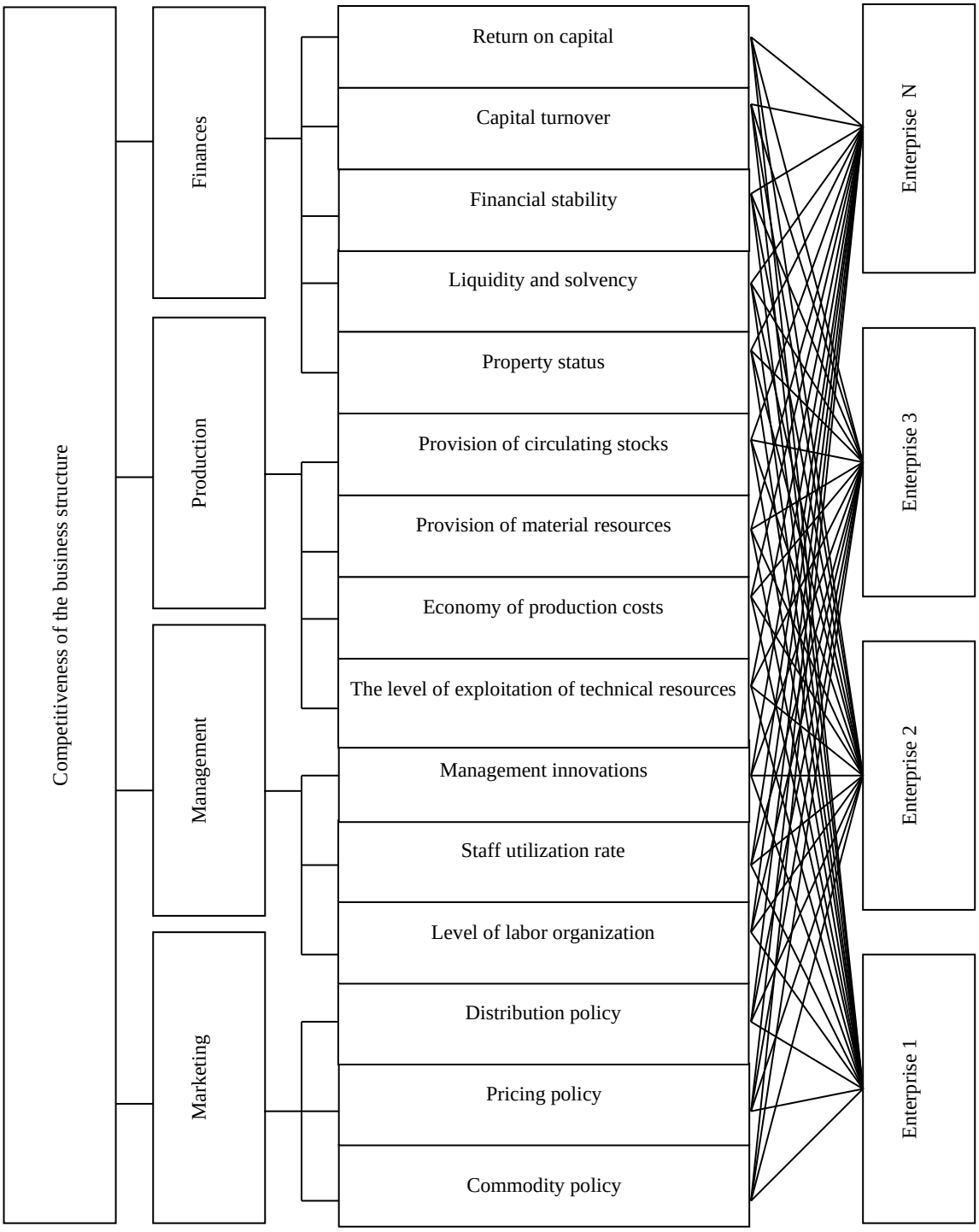

Fig. 1 Hierarchical Model of Polycriteria Rating of Competitiveness of Business Structures

In our case, it is necessary to give answers to the following questions: to what extent business structure A is more competitive in terms of product policy than business structure B or business structure C; to what extent the "management" criterion is more important than the "marketing" criterion for the competitiveness of the business structure, etc.

Experts were asked to determine the influence of the directions of competitive activity of business structures on their competitiveness. Pairwise comparison matrices were built based on the opinions of experts of selected business structures. Interesting for understanding the principles of the formation of the competitiveness of business structures are the obtained intermediate results in the process of using the method of analysis of hierarchies, namely the value of local vectors of priorities for elements of the second, third and fourth levels.

The matrix of pairwise comparisons for the elements of the second level of the multicriteria rating model of the competitiveness of business structures is presented in Table I.

TABLE I MATRIX OF PAIRWISE COMPARISONS FOR SECOND-LEVEL ELEMENTS

No	The name of the elements compared at the second level of the hierarchical model	Marketing	Management	Production	Finances	Local priorities
1	Marketing	1	0,11111	0,2	0,2	0,03641
2	Management	9	1	9	7	0,68826
3	Production	5	0,11111	1	0,2	0,08143
4	Finances	5	0,14286	5	1	0,19389
λmax=4,534348016; *CI*=0,178116005; *RI*=0,197906673						

The calculation of local priority vectors is based on the method of determining the eigenvector. The components of the eigenvector of local priorities are calculated according to the formulas:

$$\overline{u_i} = \sqrt[n]{\prod_{j=1}^{n} a_{ij}}; i = \overline{1,n} \quad (1)$$

where aij – i- element, j – column of the matrix of pairwise comparisons of criteria, n – number of criteria.

$$u_i = \frac{\overline{u_i}}{\sum_{i=1}^{n} \overline{u_i}}; i = \overline{1,n} \quad (2)$$

The algorithm for solving the considered problem is implemented using the tools of the MS Excel software application.

The next step is to check the consistency of each of the considered matrices. For this, the maximum eigenvalues and coefficients are determined - consistency index and consistency ratio. In case of inconsistency in some matrix of pairwise comparisons, experts need to revise their judgments.

The maximum eigenvalue of the inverse-symmetric matrix of pairwise comparisons is determined by the formula:

$$\lambda_{\max} \approx \sum_{j=1}^{n} u_j \left(\sum_{i=1}^{n} a_{ij} \right) \quad (3)$$

A matrix is consistent if the order of the matrix and its maximum eigenvalue coincide, i.e. $\lambda_{max}=n$.

The consistency index (CI) and ratio (RI) are calculated according to the formulas:

$$CI = \frac{\lambda_{\max} - n}{n-1} \quad (4)$$

$$RI = \frac{CI}{ICR} \quad (5)$$

The method of analyzing hierarchies allows for a certain level of inconsistency. The relative misalignment should not be more than 10% (in some cases, where there is no need for high accuracy, no more than 20% is allowed). If the VU goes beyond these limits, then the experts need to investigate the problem and check their judgments.

IV. Results and Discussion

Based on the data received (Table II), the highest priority in the formation of the competitiveness of the business structure has the "Management" criterion (the local priority is 0.688256512). The criterion "Finance" with a local priority value of 0.193894306 is the second in the hierarchy of importance, the third is "production" (the local priority is 0.081431782). The criteria "Marketing" with a value of local priority of 0.0364174 was determined by the experts to be the least influential in shaping the competitiveness of the business structure. The matrix of pairwise comparisons for the elements of the second level is consistent, because the order of the matrix and its maximum eigenvalue λ_{max} =4.534348016 coincide, and the value of the indicator of the consistency ratio is 0.197906673, which does not exceed the permissible value of 20%.

TABLE II MATRICES OF PAIRWISE COMPARISONS FOR ELEMENTS OF THE THIRD LEVEL

No	The name of the elements compared at the third level of the hierarchical model	Local priorities
Marketing *λmax*=3,18276681; *CI*=0,091383403; *RI*=0,157557591		
1	Commodity policy	0,218494368
2	Pricing polic	0,714709565
3	Distribution policy	0,066796068
Production *λmax*=4,309401077; *CI*=0,103133692; *RI*=0,114592991		
1	The level of exploitation of technical resources	0,069481574
2	Economy of production costs	0,601728085
3	Provision of material resources	0,120345617
4	Availability of working capital	0,208444723
Managment *λmax*=3,20846856; *CI*=0,10423428; *RI*=0,179714276		
1	Level of labor organization	0,72193361
2	Staff utilization rate	0,051008933
3	Management innovations	0,227057457
Finances *λmax*=5,86015729; *CI*=0,215039322; *RI*=0,191999394		
1	Property Status	0,051142964
2	Liquidity and solvency	0,035250314
3	Financial stability	0,547076023
4	Capital turnover	0,115337159
5	Return on capital	0,251193539

The next stage of the multi-criteria ranking of the competitiveness of business structures involves the analysis of all sub-criteria of the third level relative to each element-criterion of the second level (refer to Table II). According to the values of local priorities given in Table II, following the "Marketing" criterion, the highest priority belongs to the "Pricing policy" subcriterion, the local priority of which is 0.714709565. Less important is the sub-criterion

"Commodity policy," with a local priority value of 0.218494368. The least influential factor in the formation of the marketing policy of the business structure was determined by experts to be the sub-criterion "Distribution policy," with a local priority value of 0.066796068.

The matrix of pairwise comparisons for the elements of the third level according to the criterion "Marketing" is consistent, since the order of the matrix and its maximum eigenvalue λmax = 3.18276681 coincide, and the value of the consistency ratio indicator is 0.157557591, which does not exceed the permissible value of 20%.

According to the "Management" criterion, the highest priority belongs to the sub-criterion "Level of labor organization", the local priority of which is 0.72193361. The second most important sub-criterion is "Management innovations" with a local priority value of 0.227057457. The least influential in the formation of business structure management policy was determined by experts to be the subcriterion "Level of staff utilization" with a local priority value of 0.051008933.

The matrix of pairwise comparisons for the elements of the third level according to the criterion "Management" is consistent, since the order of the matrix and its maximum eigenvalueλmax =3.20846856 coincide, and the value of the indicator of the consistency ratio is 0.179714276, which does not exceed the permissible value of 20%.

According to the criterion "Production", according to experts, the highest priority belongs to the sub-criterion "Economy of production costs", the local priority of which is 0.601728085. The second most important is the subcriterion "Ensurement with working capital" with a local priority value of 0.208444723. The sub-criteria "Ensurement of material resources" and "Level of exploitation of technical resources" with local priority values of 0.120345617 and 0.069481574, respectively, were set by experts to be almost equally influential in the production policy of the business structure.

The matrix of pairwise comparisons for the elements of the third level according to the criterion "Production" is consistent, because the order of the matrix and its maximum eigenvalue λmax =4.309401077 coincide, and the value of the indicator of the consistency ratio is 0.114592991, which does not exceed the permissible value of 20%.

According to the criterion "Finances", the sub-criterion "Financial stability" with a local priority of 0.547076023 is set as the most priority. The second most important sub-criterion "Return on capital" was determined with a local priority value of 0.251193539. Experts consider the subcriterion "Capital turnover" less important, the value of which local priority is 0.115337159. Almost equally influential in the financial policy of the business structure, the experts set the sub-criteria "Property condition" and "Liquidity and solvency" with local priority values of 0.051142964 and 0.035250314, respectively.

Improvement of Staff Management on the Basis of Digitalization

The competitiveness of business structures can be assessed in several ways. These include evaluating competitiveness based on economic activity results, using a factor approach to analyze competitiveness, and considering how a business structure's strategy impacts its competitiveness. Key indicators for assessing competitiveness include economic potential, efficiency of activity, management level, production and sales potentials, research potential, financial position, company reputation, state and qualification of labor resources. These indicators can be grouped into categories such as production activity efficiency, financial condition, sales organization efficiency, product competitiveness, and innovative activity efficiency.

The matrix of pairwise comparisons for the elements of the third level according to the criterion "Finance" is consistent, since the order of the matrix and its maximum eigenvalue λmax =5.86015729 coincide, and the value of the consistency ratio indicator is 0.191999394, which does not exceed the permissible value of 20%.

Using the principle of synthesis, we determine the global priorities of the elements of the third level:

$$Z_i = V_{ij} U_i, \quad (6)$$

where V_{ij} – local priority (weight factor) of the i-th element of the third level in relation to the j-th element-criterion of the second level.

We determine the local priorities for the fourth level relative to each subcriterion of the third level (calculation results are shown in Tables III–VI).

According to the calculations of the local priorities of the elements of the fourth level relative to the elements-subcriteria of the third level of the "Marketing" criterion, given in the Table III, business structure A is more competitive according to the sub-criteria "Product policy", "Price policy", "Distribution policy" than business structures B and C, as evidenced by the local priorities, the value of which is 0.730644671, respectively; 0.772017108 and 0.636985572.

TABLE III LOCAL PRIORITIES OF THE ELEMENTS OF THE FOURTH LEVEL RELATIVE TO THE SUB-CRITERIA ELEMENTS OF THE THIRD LEVEL OF THE "MARKETING" CRITERION

Commodity policy	**Local priorities**
A	0,730644671
B	0,188394097
C	0,080961232
λmax=3,06488758; C*I*=0,03244379; *RI*=0,055937569	
Pricing policy	**Local priorities**
A	0,772017108
B	0,17343526
C	0,054547632
λmax=3,20846856; *CI*=0,10423428; *RI*=0,179714276	
Distribution policy	**Local priorities**
A	0,636985572
B	0,258284994
C	0,104729434
λmax=3,03851109; *CI*=0,019255545; *RI*=0,033199216	

The competitive environment imposes demands on the companies, that operate in it to constantly respond to changes in the market situation, to find innovative solutions and thus gain advantages over competitors. More dynamic companies quickly master new types of production, new markets, and sometimes even entire industries. Such companies can also quickly leave these industries or stop producing products, if they detect significant threats from competitors in a timely manner.

TABLE IV LOCAL PRIORITIES OF ELEMENTS OF THE FOURTH LEVEL RELATIVE TO ELEMENTS-SUBCRITERIA OF THE THIRD LEVEL OF THE "MANAGEMENT" CRITERION

Level of labor organization	**Local priorities**
A	0,785391188
B	0,14881507
C	0,065793742
λmax=3,08029984; *CI*=0,040149922; *RI*=0,069224003	
Staff utilization rate	**Local priorities**
A	0,72193361
B	0,227057457
C	0,051008933
λmax=3,20846856; *CI*=0,10423428; *RI*=0,179714276	
Management innovations	**Local priorities**
A	0,785391188
B	0,14881507
C	0,065793742
λmax=3,08029984; C*I*=0,040149922; *RI*=0,069224003	

Business structure B is less competitive, the numerical value of local priorities is determined at the level of 0.188394097; 0.17343526 and 0.258284994, respectively. Business structure B was determined by experts to be the least competitive in the formation of marketing policy, the values of local priorities according to the sub-criteria elements of the "Marketing" criterion are 0.080961232, respectively; 0.054547632 and 0.104729434.

The matrix of pairwise comparisons for the elements of the fourth level relative to the elements-subcriteria of the third level of the criterion "Marketing" is consistent, since the order of the matrix and its maximum eigenvalue coincide (*λmax* =3.06488758 for the subcriterion "Commodity policy", *λmax* =3.20846856 for the subcriterion " Price policy", *λmax* =3.03851109 for the sub-criterion "Distribution policy"), and the value of the consistency ratio indicator does not exceed the permissible value (0.055937569 for the sub-criterion "Commodity policy", 0.179714276 for the sub-criterion "Price policy", 0.033199216 for the sub-criterion "Distribution policy").

Calculations of the local priorities of the elements of the fourth level relative to the sub-criteria elements of the third level of the "Management" criterion (Table IV) show that business structure A is more competitive according to the sub-criteria "Level of labor organization", "Level of staff utilization", "Management innovations", than business structures B and B; value of local priorities, respectively, is 0.785391188; 0.72193361 and 0.785391188. Business structure B is less competitive, the numerical value of the corresponding local priorities is determined at the level of 0.14881507; 0.227057457 and 0.14881507. Business structure B was found to be the least competitive in the formation of management policy by experts, the value of local priorities according to the sub-criteria elements of the "Management" criterion is 0.065793742, respectively; 0.051008933 and 0.065793742.

The matrix of pairwise comparisons for the elements of the fourth level relative to the elements-subcriteria of the third level of the criterion "Management" is consistent, since the order of the matrix and its maximum eigenvalue coincide (λmax =3.08029984 for the subcriterion "Level of work organization", λmax =3.20846856 for the subcriterion "Level of personnel utilization", λmax =3.08029984 for the subcriterion "Management innovations"), and the value of the consistency ratio indicator does not exceed the permissible value (0.069224003 for the subcriterion "Level of labor organization", 0.179714276 for the subcriterion "Level of personnel utilization" , 0.069224003 for the subcriterion "Management innovations").

According to the Table V calculations of local priorities of elements of the fourth level relative to elements-sub-criteria of the third level of the criterion "Production", the most competitive according to all sub-criteria is business structure A. Thus, accordingly, the value of local priorities according to the sub-criterion "Level of exploitation of technical resources" is 0.669416869, according to by the sub-criterion "Economy of production costs" – 0.714709565, by the sub-criterion "Ensurement with material resources" – 0.649118005, by the sub-criterion "Ensurement by working capital" - 0.730644671. Business structure B was determined by experts to be less competitive in the formation of production policy, the numerical value of local priorities was determined at the level of 0.242636922; 0.218494368, 0.278954565 and 0.188394097 respectively. The least competitive is business structure B, the value of local priorities according to the sub-criteria elements of the "Production" criterion are 0.087946209, 0.066796068, 0.07192743, 0.080961232, respectively.

TABLE V LOCAL PRIORITIES OF ELEMENTS OF THE FOURTH LEVEL RELATIVE TO ELEMENTS-SUBCRITERIA OF THE THIRD LEVEL OF THE "PRODUCTION" CRITERION

The level of exploitation of technical resources	**Local priorities**
A	0,669416869
B	0,242636922
C	0,087946209
λmax=3,00702177; C*I*=0,003510883; *RI*=0,006053246	
Economy of production costs	**Local priorities**
A	0,714709565
B	0,218494368
C	0,066796068
λmax=3,18276681; C*I*=0,091383403; *RI*=0,157557591	
Provision of material resources	**Local priorities**
A	0,649118005
B	0,278954565
C	0,07192743
λmax=3,06488758; C*I*=0,03244379; *RI*=0,055937569	
Availability of working capital	**Local priorities**
A	0,730644671
B	0,188394097
C	0,080961232
λmax=3,06488758; C*I*=0,03244379; *RI*=0,055937569	

The matrix of pairwise comparisons for the elements of the fourth level relative to the elements-subcriteria of the third level of the criterion "Production" is consistent, since the order of the matrix and its maximum eigenvalue coincide (λmax =3.00702177 for the subcriterion "Level of exploitation of technical resources", λmax =3.18276681 for sub-criterion "Economy of production costs", λmax =3.06488758 for the sub-criterion "Ensurement with material resources", λmax =3.06488758 for the sub-criterion "Ensurement with working capital"), and the value of the consistency ratio indicator does not exceed the permissible value (0.006053246 for the sub-criterion " The level of exploitation of technical resources", 0.157557591 for the sub-criterion "Economy of production costs", 0.055937569 for the sub-criterion "Ensurement of material resources", 0.055937569 for the sub-criterion "Ensurement of working capital").

Listed in the Table VI calculations of the local priorities of the elements of the fourth level relative to the elements-subcriteria of the third level of the "Finance" criterion.

TABLE VI LOCAL PRIORITIES OF THE ELEMENTS OF THE FOURTH LEVEL RELATIVE TO THE SUB-CRITERIA ELEMENTS OF THE THIRD LEVEL OF THE "FINANCE" CRITERION

Property state	**Local priorities**
A	0,584156411
B	0,280833111
C	0,135010478
λmax=3,13561084; *CI*=0,067805422; *RI*=0,116905901	
Liquidity and solvency	**Local priorities**
A	0,636985572
B	0,258284994
C	0,104729434
λmax=3,03851109; C*I*=0,019255545; *RI*=0,033199216	
Financial stability	**Local priorities**
A	0,772017108
B	0,17343526
C	0,054547632
λmax=3,20846856; C*I*=0,10423428; *RI*=0,179714276	
Capital turnover	**Local priorities**
A	0,617504227
B	0,296865069
C	0,085630704
λmax=3,13561084; C*I*=0,067805422; *RI*=0,116905901	
Return on capital	**Local priorities**
A	0,714709565
B	0,218494368
C	0,066796068
λmax=3,18276681; C*I*=0,091383403; *RI*=0,157557591	

"Finance" criterion show that business structure A is determined to be the most competitive according to all subcriteria. Thus, the corresponding values of local priorities according to the subcriteria are: subcriterion "Property status" – 0.584156411, sub-criterion "Liquidity and solvency" – 0.636985572, sub-criterion "Financial stability" – 0.772017108, sub-criterion "Turnover of capital" – 0.617504227, sub-criterion "Return on capital" – 0.714709565.

Business structure B was determined by experts to be less competitive in the formation of financial policy according to all subcriteria, the corresponding numerical values of local priorities were determined at the level of 0.280833111, 0.258284994, 0.17343526, 0.296865069 and 0.218494368. Business structure B is the least competitive, the values of local priorities according to the sub-criteria elements of the "Finance" criterion are 0.135010478, 0.104729434, 0.054547632, 0.085630704 and 0.066796068, respectively.

The matrix of pairwise comparisons for the elements of the fourth level relative to the elements-subcriteria of the third level of the criterion "Finance" is consistent, since the order of the matrix and its maximum eigenvalue coincide (*λmax* =3.13561084 for the subcriterion "Property status", *λmax* =03851109 for the subcriterion "Liquidity and solvency", *λmax* =3.20846856 for the sub-criterion "Financial stability", *λmax* =3.13561084 for the sub-criterion "Capital turnover", *λmax* =3.18276681 for the sub-criterion "Return on capital"), and the value of the consistency ratio indicator does not exceed the permissible value (0.116905901 for the sub-criterion "Property status", 0.033199216 for the sub-criterion "Liquidity and solvency", 0.179714276 for the sub-criterion "Financial stability", 0.116905901 for the sub-criterion "Turnover of capital", 0.157557591 for the sub-criterion "Return on capital").

We apply the principle of synthesis to determine the global priorities of the elements of the fourth level. The global priorities of the elements of the fourth level are defined as the sum of the products of the local priorities of each element of the fourth level (Wij) by the global priorities of the elements of the third level (Zij):

For business structures A, B, C, respectively, we will get:

- WA = W11Z1+W12Z2+…+W115Z15 = 0,764008807;
- WB = W21Z1+W22Z2+…+W215Z15 = 0,1700498;
- WC = W31Z1+W32Z2+…+W315Z15 = 0,065941393.

The results of multi-criteria ranking of competitiveness of business structures indicate that the highest level of competitiveness is observed in business structure A (global priority is 0.764008807). Business structure B is less competitive (the global priority is set at the level of 0.1700498). Business structure C received the lowest level of competitiveness in the rating, the global priority of which was calculated at the level of 0.065941393.

V. CONCLUSION

In order to solve the problem of multi-criteria ranking of the competitiveness of business structures as complex multidisciplinary systems, a thorough study of all spheres and directions of their functioning is necessary. Such an opportunity can be realized in the process of multi-criteria

rating assessment based on the application of the method of analysis of hierarchies as one of the practical decision-making tools in the conditions of multi-criteria tasks, taking into account the "human factor."

Due to the fact that the structure of the decision-making model is a reproduction of the actual situation in the subject area and the application of MAI allows you to break down an enormous task into several small independent tasks, it is possible to involve experts who work independently of each other on a local task for the preparation of decision-making. It is the local priorities in terms of the marketing policy of the business structure, management policy, production activity, financial policy of the business structure that make it possible to identify the strengths and weaknesses of each business structure in the specified directions and to find out their impact on the overall competitiveness of the functioning of these business structures.

We consider it expedient to focus further research on the spread of the practice of using the multidimensional analysis technique for the purpose of multi-criteria ranking of the competitiveness of business structures, in particular, the application of the Distance method and the Taxonometric method.

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