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Competitiveness of the Enterprises of the Eurasian Economic Union: Assessment Methodology

Competitividad de las empresas de la Unión Económica Euroasiática: Metodología de Evaluación

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Contents

ABSTRACT:

A generalizing approach to comparing the competitiveness of enterprises operating in a particular segment of the world market is proposed. The approach is based on the allocation of a group of basic competitiveness indicators, determination of their current and expected values at a certain point in the future, formation of the set of Pareto points (in the set of allocated enterprises) and determination of leaders in this Pareto set based on the values of generalizing criteria (formulated expertly-analytically).

Keywords: operation research, EEU, scenario modeling, game-theoretic models, competitiveness of enterprises.

RESUMEN:

Se propone un enfoque general para comparar la competitividad de las empresas que operan en un segmento particular del mercado mundial. El enfoque se basa en la asignación de un grupo de indicadores básicos de competitividad, la determinación de sus valores actuales y esperados en un momento determinado en el futuro, la formación del conjunto de puntos de Pareto (en el conjunto de empresas asignadas) y la determinación de los líderes en Este conjunto de Pareto se basa en los valores de los criterios de generalización (formulados de forma analítica y experta).

Palabras clave: investigación de operaciones, EEU, modelos de escenarios, modelos de teoría de juegos, competitividad de las empresas

1. Introduction

The concept of competitiveness is multifaceted, multidimensional. There are many different qualitative definitions of competitiveness, but no acceptable precise definition of this concept can be made since in various specific competitive economic interactions, various advantages of competing enterprises, corporations, regions, states and personalities play the leading role. At the level of qualitative analysis of an enterprise's

competitiveness, the concepts of "competitiveness," "competitive status" and "competitive advantage" are used.

Traditionally, the **competitiveness of an enterprise** is defined as a complex feature characterizing its ability to compete successfully in the market and obtain economic benefits relative to competitors. Group, integral and generalized indicators are used for the assessment of this feature.

Competitive status of an enterprise, according to I. Ansoff, is a feature of an enterprise's competitive position in the market compared to other competitors. Competitive status determines the position of the enterprise in the industry, regional or international markets.

Competitive advantages are understood as internal and external factors that allow an enterprise to improve its competitive status.

The variety of measurable in terms of quantity or quality features of each enterprise and the produced products and services is very large. For each such feature, at the level of common sense expertise, it is possible to determine whether the growth in this feature has a positive or negative impact on the competitiveness of an enterprise. Only in comparison with competitors can competitiveness be assessed. A comprehensive approach can be considered as a variation of competitiveness assessment methodology, according to which:

- Competitiveness is analyzed within a group of enterprises (agents) operating in a certain segment of the world market;

- The variety of measurable features of an enterprise is considered and within the considered group, a Pareto set of enterprises, not dominated in all features by one member of the group, is formed;

- A list of expert-approved generalizing criteria for competitiveness that define competitiveness as a function of the values of the features under consideration is formed;

- In the set of drawn Pareto points, a subset of enterprises, leading by the value of one or more generalizing criteria, is allocated. The enterprises of this subset are considered the most competitive; leaders in several criteria are assessed as the most competitive.

In other approaches, the set of measurable features is narrowed (a subset is separated from it, the rest is rejected), factored (groups of features are folded into one) or/and both narrowed and factored. The procedure for drawing a set of Pareto points is excluded; only one generalizing criterion is used. Financial, economic, marketing and integrating approaches to assessing competitiveness are used. One of the key indicators of competitiveness used is an enterprise's share in the market of similar products. The connection between innovations and competitiveness is outlined in (Kashirin, 2018; Chursin, Kashirin, Strenalyuk et al, 2018; Kiseľáková et al., 2018; Korauš et al., 2018; Gerasimov et al., 2018; Girdzijauskaite et al., 2019; Kiselev, Degtereva, Zobov, Moseykin, and Kokuytseva, 2018; Rodionova, Kokuytseva and Semenov, 2018; Rodionova, Shuvalova and Kokuytseva, 2017).

In the approach, proposed by the Ye.P. Golubkov (1999), 16 factors of performance of activities of an enterprise are used to assess its competitiveness: image, concept and quality, other factors of competitiveness of products and services and efficiency of marketing activities relative to products and services, level of business diversification, total market share of major types of business, capacity of R&D complex, production capacity, etc. In the approach proposed by J.J. Lambin (1992), competitiveness is assessed expertly-analytically on a 5-point scale based on six criteria (indicators): relative market share; peculiarities of the goods; costs; rate of adoption of technologies; channels of distribution; image. The method of assessing the competitiveness of an organization on the basis of "4P" is associated with a comparative analysis of the organization and competing enterprises considering the following factors: product, price, promotion and place. Other approaches use SWOT analysis of the strengths and weaknesses of enterprises. The following methods are used as well: rating assessments

of the competitiveness of an enterprise establishing a hierarchy of companies based on the comparison of their achievements in financial and other areas; assessments of the competitiveness of an enterprise based on a comprehensive study of the internal environment of the enterprise; matrix method of competitiveness assessment proposed by the Boston Consulting Group (used to assess the competitiveness of goods, certain companies and sectors of the "growth – share" matrix; the theory of effective competition, according to which, the most competitive are those enterprises where work of all departments and services is organized the best. Various "competitiveness polygons" are used to visualize the results of a competitor's activity comparison. Along the radial axes of these competitiveness polygons, the shares of the enterprise relative to the leader in terms of this indicator are marked.

In this paper, based on a generalizing analysis of the approaches used to assess the competitiveness of enterprises (corporations), the following is proposed:

- To factor (aggregate) the variety of the measurable features of the enterprise in question so that in the aggregated form, none of these features is lost;

- To not simplify the above-mentioned scheme of a comprehensive approach to competitiveness assessment (drawing a set of Pareto points in the group of competing enterprises under consideration, forming a list of generalizing criteria, highlighting leaders by generalizing criteria in the drawn set of Pareto points);

- To use in assessing competitiveness both the values of aggregated features measured or estimated currently and the predicted values of the same features in the future, in a certain expertly determined period of time;

- To use simulation models of production and economic activities of competing enterprises based on operational game scenario modeling for assessment of predicted values of the aggregated features.

The methodology of operational game scenario modeling has developed as a generalizing trend in mathematical game theory, the basics of which were presented in (Neumann & Morgenstern, 1970), in the process of practical work in the field of decision-making support and production and economic forecasting (Federal Target Program "Reforming and Developing the Defence-Industrial Complex in 2002-2006", development of the Moscow Government Industrial Policy in 2007-2009, General Scheme for Development and Distribution of Moscow Industry in 2008-2020, modeling module of the Situation Center of the Government's Automated System of the Government's Defence Order). At the same time, the developments of the game theory school with nonantagonistic interests of Yu.B. Germeyer were actively used (Germeyer, 1976; Germeyer & Vatel, 1974). This methodology has been tested on a number of problems of both micro and macroeconomic nature (Kononenko & Shevchenko, 2004, 2013; Yereshko & Shevchenko, 2014).

Based on the stated approach, it is proposed to develop a software package that allows conducting an assessment of the competitiveness of key enterprises and corporations of the EAEU, producing products and services in different segments of the world market, in comparison with foreign competitors.

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2. Materials and Methods

The proposed approach to assessing competitiveness involves the use of holistic and coupled models of production and economic activity of the competing enterprises under consideration for simulation modeling and assessment of prospects for the development of these enterprises. As a tool for drawing such models, we intend to use the methodology of operational game scenario modeling based on the theory of operating games, considering various operational game interactions (Kononenko & Shevchenko, 2004, 2013; Yereshko & Shevchenko, 2014; Ereshko and Kokuytseva, 2017).

The dynamics of operational game interaction represent a change in time of:

- Turnovers and balances of players' basic accounts as a result of transactions related to operations;

- Information available to players;

- Players' contractual obligations;

- Choices that players make during various operations;

- Implemented values of uncertain factors;

- Values of operations management vectors, determined by player choices and the implementation of uncertain factors.

Each operation is associated with a certain set of transactions, the application of which changes the turnovers and balance of the base accounts and, perhaps, the parameters of operations themselves. The transactions are divided into classic, generalized and operator. Classic transactions spend the same amount on the debit of one account and on the credit of another one (which can be both positive and negative). Generalized transactions affect several accounts, entering their own amount on debit or credit each of them. Operator transactions change the parameters of transactions and operations as intended. The amounts in the description of transactions are set not as specific values, but in the form of functions from the operations management vector, in which they are included. A vector, whose value currently is determined by a particular game procedure, is presented in the description of the operation. That is why every operation is a classic static game.

When describing the operating game, the following is defined:

- A set of players' basic accounts (N – number of players);

- A set of transactions , the effect of each of which, when applied, depends on the vector of management (the function of the transaction amounts depends on the values of the component of this vector), the value of which is determined by players' choices and implementation of the relevant uncertainties in the current operation;

- A set of operations under consideration .

The operation of the operating game refers to a set of:

- A subset of players LPR$\beta \subseteq I$ involved in the decision-making process;

- A subset of a set of game transactions which are implemented during the operation;

- A determinate function (algorithm) of folding the operation , which determines the relationship between the value of a unified vector variable at a time and the changes in turnovers and account balance , the joint choice of LPRβ the players entering this transaction and implementation of uncertain factors associated with this operation, prior to the moment when the operation takes place and the value of the moment itself.

This definition of operating game operations is in essence "corresponding to scientific rigor" formal definition of "economic life fact", which is understood as a fact represented at one point (tact) of discrete time, in which the process under consideration is observed and recorded, "the simplest fact of economic life" (transfer by one player to another a certain amount, recognition of material assets, simple productive action, etc.) in production and economic practice and accounting. However, at the same time, because in the operational game simulation modeling the tact time can be an hour, a day, a month, as well as a year, in the form of an operation of the operating game, "economic operations", whose performance time is stacked in one tact of discrete time of the game model, can be presented. In reality, economic operation is a sequence of economic life facts linked to one holistic action. When modeling an economic operation in the form of an operating game operation into a set of transactions of the latter, all transactions of all economic life facts that make up this economic operation should be included. A set of operating game operations of decision makers should include all participants in the economic operation, making decisions about with what controls (volumes, prices, interests, etc.) the modelled economic operation is performed. The function of folding should model harmonization of operations management by those who are present in a set of decision makers in the form of game interaction.

The narrative design of the operating game operation is flexible and capacious enough to

represent naturally and adequately a wide range of real production and economic operations: exchange (purchase and sales of products, services, labor services), manufacturing, innovative modernization, credit, investment, tax, consumer, training, healthcare, environmental, social, demographic, destructive operations, as well as operations on performing R&D services. At the same time, sets of transactions of the operation, which simulates a real economic operation, are naturally made up of those transactions that take place in the accounting of this economic operation. In determining the type of functions of the folding, the specifics of the procedures set in modelled real production and economic interaction of joint decision-making by the participants of this interaction are taken into account. Formalization of real operations can be carried out with a different degree of detail of accounts, depth of reflexive interaction and the complexity of the functions of the amounts of the model operation transactions.

In the modeling of lending and investment processes, contractual relationships, strategies of behavior of players IF <condition> THEN <action> OTHERWISE, <sanction> obligations are used in which such formats as <conditions>, <actions> <sanctions> are strictly stipulated. Lending and investment processes are modelled as a linked set of static games sequence and a list of obligations.

The dynamics of operational game interactions are described by a system of nonlinear equations with logical inclusions and restrictions.

The presence of joint restrictions (basic and possibly otherwise) leads to conflicts between operations (multiple operations require the same resource in quantities that are not available, etc.). As a result, there is a need for procedures to resolve such conflicts by changing the vectors of the controls of conflicting operations. Unification of such procedures is hardly appropriate; in each case they can be taken individually, taking into account the specifics of the game interaction.

Another tool that is proposed to be used in the process of assessing the competitiveness of enterprises is the well-known methodology of multi-criterion optimization, based on the drawing sets of Pareto points, consisting of choices not dominated by any other choice by all criteria, for such problems. Sets of Pareto points can be drawn while considering game interactions. In this situation, the functions of winnings of players involved in such interactions are considered as the criteria. In this case, the joint choice of all players (the element of the set, which is the Cartesian product of the sets of player choices) is included in a set of Pareto points when and only when there is no other joint choice, in which the values of all winning features of the players are more or equal (but not all are equal) than in the joint choice under consideration.

3. Results

Using the considered tools, a well-defined methodology can be developed to assess and analyze the competitiveness of key EAEU enterprises in comparison with foreign competitors:

For one or more key EAEU enterprises whose products and services correspond to a certain segment of the world market, a complete list of enterprises operating in the same segment, including themselves (list A) is identified.

A list of integrating features (indicators) of the state and output of the activity of an enterprise is taken as a basis, which in an integrated form comprehensively describes all aspects of an enterprise’s activities, each of which can be identified for the current time period (List B) (Table 1).

Table 1
One of the versions of the list of
integrating features (indicators) (List B)

#	Integrating features (indicators)
1	Net assets, their ratio to capital and the net profitability of the enterprise (ratio of net profit to net

	assets);
2	Share in the relevant segment of the world market and the EAEU market;
3	Basic assets, their wear and tear, the return on fixed assets (ratio of revenues from sales of products to basic assets);
4	Current liquidity ratio (ratio of circulating assets to advance commitments);
5	Equity to total assets ratio (own funds to balance currency);
6	The number of staff, the share of employees with higher and secondary specialized education;
7	The ratio of sales volume to the critical volume of output (volume of output at zero return);
8	Percentages of capacity utilization and deployment of staff.

A set of operating game models of production and economic activity of enterprises, using which one can adequately (according to recognized experts) describe the activities of any of the enterprises the group in question, is developed. Software for simulation modeling is created using these models.

For each of the enterprises under consideration, a scenario plan of possible scenarios of its production and economic activities within the framework of its chosen operating game model is developed for the period set by the experts (1, 2, 3 years or more). The probabilities (chances) of implementing each of the scenarios of the scenario plan are assessed expertly. Using simulation modeling, mathematical expectations of the values of the allocated features (indicators) at the end of a given period are assessed.

In the group of competing enterprises in question, a set of Pareto enterprises that are not dominated by the set of current values and predictive mathematical expectations of the features used is highlighted. Enterprises that are not part of this Pareto set are considered uncompetitive. A list of expert-approved generalizing criteria for competitiveness is developed. The leaders on the values of one or more of these criteria are singled out. Such leaders are among the most competitive.

4. Discussion

Comparing the proposed methodology for assessing the competitiveness of enterprises with those used in world practice, the following can be noted:

1) In the proposed approach, the existing world experience is taken into account and integrated into a holistic and interconnected methodology, actively using the developments of modern game theory and study of the operations.

2) Under the proposed approach, drawing a comprehensive scenario plan of possible scenarios in the process of production and economic activities of competing enterprise and simulation modeling with the necessary assessments of each of these scenarios for each of the analyzed group of competing enterprises makes an important contribution to the existing methods for assessing the competitiveness of competing enterprises.

3) The proposed software package for assessing the competitiveness of the enterprises of the EAEU can allow assessing various options for modernizing existing enterprises and changing strategies for managing their development.

5. Conclusion

The paper describes the methodology of qualitative assessment of the competitiveness of enterprises. The methodology is also related to the development of brainwear to develop a software package, which allows each of the key enterprises (corporations) of

the EAEU, by allocating a group of global manufacturers of products and services in the same market segment, to assess the place of this key enterprise in the allocated group. Whereby other enterprises of the EAEU may be present in this group, various generalizing criteria of competitiveness can be considered and used. Assessments will be carried out not only on the basis of an assessment of the current states of the enterprises under consideration but also using a large-scale simulation modeling of various scenarios for the development of production and economic activities of these enterprises.

Proposed as the basis of simulation modeling of the activities of enterprises and corporations, the methodology of operational game scenario modeling allows developing the proposed methodology and brainware of software package, improving and detailing the description of production and economic activities of enterprises in the form of operational game interaction.

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