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**Zapukhliak I.**

*Doctor of Economics, Professor,  
Ivano-Frankivsk National Technical University of Oil and Gas, Ukraine;  
e-mail: zapib@ukr.net; ORCID ID: 0000-0002-1218-0251*

**Shегда A.**

*Doctor of Economics, Professor,  
Taras Shevchenko National University of Kyiv, Ukraine;  
e-mail: shegda12@univ.net.ua; ORCID ID: 0000-0002-3708-9526*

**Mykytiuk O.**

*Ph. D. in Economics,  
Associate Professor of the Department of Business Economics,  
Taras Shevchenko National University of Kyiv, Ukraine;  
e-mail: mykytiuk.oxana@gmail.com; ORCID ID: 0000-0002-8657-7278*

**Onysenko T.**

*Ph. D. in Economics,  
Assistant of the Department of Business Economics,  
Taras Shevchenko National University of Kyiv, Ukraine;  
e-mail: onysenko.t@gmail.com; ORCID ID: 0000-0003-2176-4168*

**Petrenko K.**

*Ph. D. in Economics, Associate Professor,  
Associate Professor of the Department of International Economics,  
National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute», Ukraine;  
e-mail: petrenko.katarina@gmail.com; ORCID ID: 0000-0002-2322-9030*

## **THEORY AND PRACTICE OF ASSESSING THE LEVEL OF INSTABILITY OF THE EXTERNAL ENVIRONMENT OF THE ENTERPRISE IN A HYBRID WAR**

**Abstract.** Current trends in the globalization economy, especially in the context of economic crises caused by hybrid war, COVID-19, lead to a constant search for new methods of enterprise management that could ensure its effective functioning. The purpose of the study is to substantiate the theoretical and methodological aspect of determining the level of instability of the external environment of the enterprise. When forming an enterprise development strategy, it is necessary to take into account all components and criteria, including factors of variability and complexity of assessing the external impact on the level of enterprise instability, and their differentiation for enterprises in different sectors of the economy. Identification of the level of instability of the external environment is the analytical basis for the predictability of its changes, which affects the choice of management methods and directions (strategies) of its development. The article proposes a methodological approach to comprehensive assessment of the level of instability of environmental factors of enterprises, which, unlike others, involves the detection of instability in terms of seven components (socio-demographic, economic, technological, environmental, political, legal, ethical) on four criteria: complexity, interdependence, variability and uncertainty of factors, which makes it possible to determine their sources and nature, and thus form an effective response of the enterprise to change. The offered methodical approach concerning activity of the gas transport enterprises of Ukraine which are the most unstable in the conditions of the crisis phenomena is tested. The obtained results are the basis for the development of scientifically sound management decisions, forecasting the behavior of the enterprise in close connection with its external environment, which will avoid crises and ensure the sustainability of their operation and development. The current challenges of enterprises in connection with the emergence of various manifestations of hybrid warfare in the country are prompting business units to create and implement new methods of managing such structures.

**Keywords:** environmental factors, level of instability, methodological approach, management, economy, hybrid war.

**JEL Classification** M12, M14, I10

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**Запухляк І. Б.**

*доктор економічних наук, професор,  
професор кафедри менеджменту та адміністрування,  
Івано-Франківський національний технічний університет нафти і газу, Україна;  
e-mail: zapib@ukr.net; ORCID ID: 0000-0002-1218-0251*

**Шегда А. В.**

*доктор економічних наук,  
професор кафедри економіки підприємства  
Київського національного університету імені Тараса Шевченка, Україна;  
e-mail: shegda12@univ.net.ua; ORCID ID: 0000-0002-3708-9526*

**Микитюк О. П.**

*кандидат економічних наук, доцент,  
доцент кафедри економіки підприємства  
Київського національного університету імені Тараса Шевченка, Україна;  
e-mail: mykytiuk.oxana@gmail.com ; ORCID ID: 0000-0002-8657-7278*

**Онисенко Т. С.**

*кандидат економічних наук,  
асистент кафедри економіки підприємства  
Київського національного університету імені Тараса Шевченка, Україна;  
e-mail: onysenko.t@gmail.com; ORCID ID: 0000-0003-2176-4168*

**Петренко К. В.**

*кандидат економічних наук, доцент,  
доцент кафедри міжнародної економіки  
Національного технічного університету України «Київський політехнічний інститут  
імені Ігоря Сікорського», Україна;  
e-mail: petrenko.katarina@gmail.com; ORCID ID: 0000-0002-2322-9030*

## **ТЕОРІЯ І ПРАКТИКА ОЦІНЮВАННЯ РІВНЯ НЕСТАБІЛЬНОСТІ ЗОВНІШНЬОГО СЕРЕДОВИЩА ПІДПРИЄМСТВА В УМОВАХ ГІБРИДНОЇ ВІЙНИ**

**Анотація.** Сучасні тенденції у глобалізаційній економіці, особливо в умовах економічних криз, спричинених COVID-19, гібридною війною та іншими, призводять до постійного пошуку нових методів управління підприємством, які могли б забезпечити його ефективне функціонування. Метою дослідження є обґрунтування теоретико-методологічного аспекту визначення рівня нестабільності зовнішнього середовища підприємства. При формуванні стратегії розвитку підприємства потрібно враховувати всі складові та критерії, у тому числі фактори мінливості та складності оцінки зовнішнього впливу на рівень нестабільності підприємства, їхню диференціацію для підприємств різних галузей економіки. Виявлення рівня нестабільності зовнішнього середовища є аналітичною основою передбачуваності його змін, що впливає на вибір методів управління і напрямів (стратегій) його розвитку. Запропоновано методичний підхід до комплексної оцінки рівня нестабільності екологічних факторів підприємств, який, на відміну від інших, передбачає виявлення нестабільності за семи складовими (соціально-демографічною, економічною, технологічною, екологічною, політичною, правовою, етичні) за чотирма критеріями: складність, взаємозалежність, мінливість і невизначеність факторів, що дає змогу визначити їхні джерела і природу, а отже, сформулювати ефективну реакцію підприємства на зміни. Апробовано запропонований методичний підхід до діяльності газотранспортних підприємств України, які є найбільш нестабільними в умовах кризових явищ. Отримані

результати є основою для розроблення науково обґрунтованих управлінських рішень, прогнозування поведінки підприємства в тісному зв'язку з його зовнішнім середовищем, що дозволить уникнути криз і забезпечить стійкість їхнього функціонування та розвитку. Сучасні виклики підприємств у зв'язку з появою у країні різноманітних проявів гібридної війни спонукають бізнес-одиниці створювати і впроваджувати нові методи управління такими структурами.

**Ключові слова:** фактори зовнішнього середовища, рівень нестабільності, методологічний підхід, управління, економіка, гібридна війна.

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**Introduction.** The heterogeneity of factors of the external environment of an enterprise, their complex hierarchy and interdependence, and complex mechanism of the relationship between changes in factors of the external environment and parameters of the enterprise enhance the complexity of quantifying the instability of the environment and its impact on a particular enterprise. The conditions of the hybrid war, that Ukraine has been witnessing since 2014, require the enterprises to be flexible, able to withstand challenges of economic and social security, protection of cyberspace and political environment. The same factors determine the external environment of an enterprise and determine the effectiveness of its operation comprehensively, in the system.

Identification of the level of instability of the external environment is the analytical basis for the predictability of its changes, which affects the choice of directions of development of an enterprise. There are many scientific approaches to differentiating the instability of the environment, which allows determining the types and characteristics of such an environment, determining the factors influencing the level of instability of the environment of an enterprise, and outlining methods for predicting future changes [1]. The components of the external environment and their interaction are considered in [1—18] Roger B. Mason [12] studied the impact of instability and uncertainty of the external environment on the management and strategy of organizations. The author studied the behavior of successful and unsuccessful IT companies and justified the choice of their strategic behavior depending on the variability of the external environment.

Some applied aspects of the study of the instability of the environment are considered in the paper by J. Nicholas Ashill & D. Jobber [13]. The study of the instability of the environment was based on Milliken's distinction between state uncertainty, effect uncertainty, and response uncertainty. The authors based on empirical data explored the relationships between two environmental characteristics and perceptions of the state, effect and response uncertainty, and the moderating role of marketing decision-maker locus of control.

However, most of the study is theoretical, but solving the problem of practical parametric assessment of the instability of the external environment of the enterprises in hybrid war and impact on their development requires thorough study and taking into account the specifics of a particular industry, in our case — gas, and state.

Therefore, as noted by B. Karloff, «...the logic of some industries is extremely complex and requires thorough analysis and good intuition. A leader who succeeds in one field may fail in another, and vice versa. Leadership does not exist separately from the logic of the industry...» [2, p. 50]. Agreeing with him, we note that each industry has the specifics of the relationship between the functioning of its subjects, level of competition, technology, legal regulation, institutional support, faithfulness and access to information, etc.

**Literature review.** The method of I. Ansoff, based on the construction of a matrix, which provides qualitative characteristics of factors of the external environment (habitually, rate of change, and predictability) was one of the first methodological developments to assess the level of instability of the environment. Then each qualitative characteristic is translated into scores, according to the instability scale. I. Ansoff suggested assessing the instability of the environment according to a five-level scale: relative stability (2.5—3 scores), reactivity (3—3.5 scores),

forecasting long-term changes (3.5—4 scores), predicting medium-term changes 4—4.5 scores), and study of short-term changes (4.5—5 scores). Specific strategic management has been proposed concerning either level of instability of the environment [3, p. 402].

The structural approach to identifying the level of instability of the environment by American researcher R. Duncan (Duncan, 1979), according to which the industry environment is divided into components of influence (consumers, competitors, suppliers, government regulation, political thought, society, trade unions (to date, the influence of this component has been removed from the study), and estimate the level of uncertainty of each element separately, is also worth noting [4, p. 314]. R. Duncan formalized the system of assessing the insignificance of the external environment in a visual matrix (Fig. 1), following the principles of «simple-complex» and «stable-unstable». Assessing the uncertainty of the external environment according to the «simple-complex» principle is related to the number of different external elements related to the activities of an enterprise; whereas the «stable-unstable» principle is related to the pace of change in the external environment.

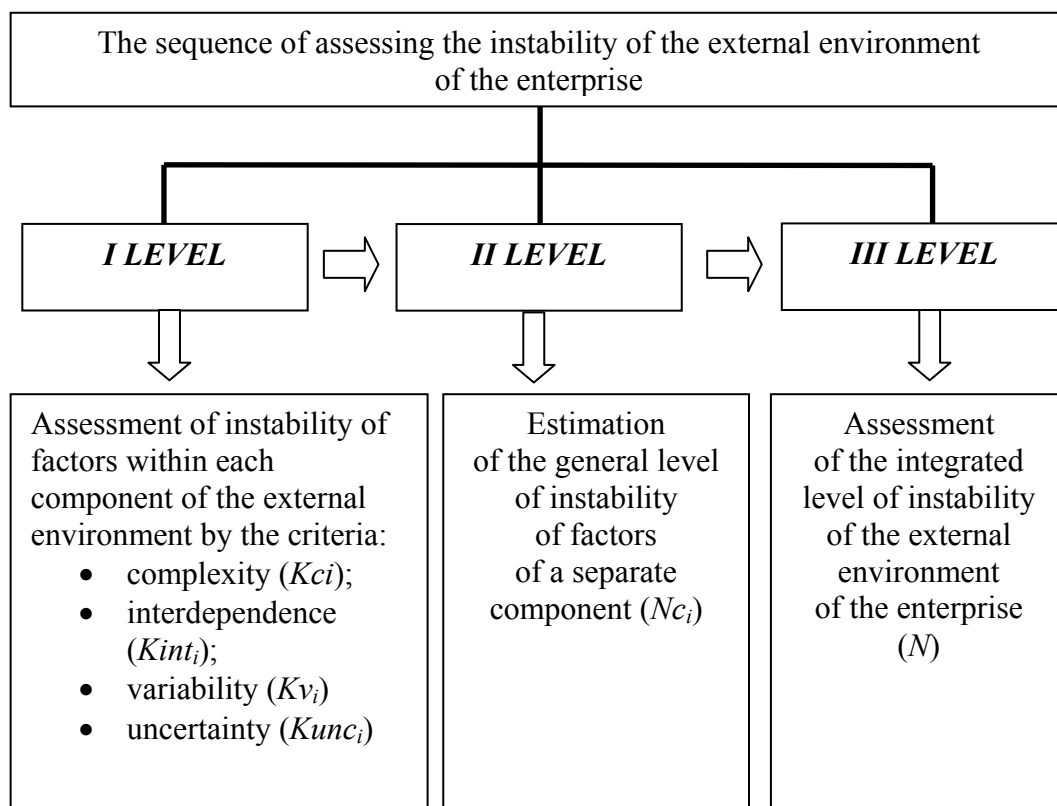


Fig. 1. System for assessing the instability of the external environment of the company

Source: developed by the authors.

A. Mazaraki et al. differentiated the instability of the environment about the criteria of variability, dynamics, and fluency [6, p. 82]. M. Povidaychyk suggested assessing the uncertainty of the external environment based on a model based on indicators of complexity and variability [7, p. 62]. O. Drin expanded the method of a quantitative study of the characteristics of instability of the external environment and suggested the following criteria such as measures to determine the level of instability of the external environment: the criterion of any trends in changes in the indicators being studied; the criterion of the variability of changes; the criterion of the spontaneity of serious changes and the criterion of periodicity of differentiation of variability of changes [8, p. 5].

**Methodology.** Taking into account the experience of foreign and domestic scientists concerning the methodology of a quantitative assessment of instability of the external environment, and taking into account the qualitative characteristics of instability of the external environment, we

suggest assessing the level of instability of the external environment concerning the following main criteria:

1. Complexity characterizes the environment by the «simple-complex» principle; the environment is simple if the number of factors is small; it is complex if the number of factors is big.
2. Interdependence of factors, which characterizes type, direction, and strength of the relationship of environmental factors.
3. Variability determines the nature of trends in factors and their spontaneity.
4. The uncertainty reflects the level of uncertainty of information on the behavior of environmental factors.

The application of a comprehensive approach to assessing the level of instability of the external environment is based on a three-level assessment system, built by the principle «from partial to general», i.e. at the first stage we assess the instability of specific factors of every component of the environment; at the second — we assess the general level of instability of every component, and at the third — the integrated level of instability of the external environment (see Fig. 1).

Note that the causes of instability of the external environment are multiple, so in this case, we will try to measure the instability of the external environment as a consequence of some independent changes that can be analyzed together. Given the proposed criteria, we can distinguish the following indicators of assessment, which will identify the level of instability of the factors of every component of the external environment of an enterprise:

1. Let's estimate the complexity of the factors of each component of the external environment of the enterprise using the share of factors of every specific component of the external environment in the total number of factors selected by experts for analysis, formula (1):

$$Kc_i = \frac{n_{fci}}{n}, \quad (1)$$

where  $Kc_i$  is the coefficient of the complexity of factors within a specific component of the external environment;

$n_{fci}$  is the number of factors of the  $i^{\text{th}}$  component, selected by experts as the most important in terms of analysis of this component;

$n$  is the number of factors in general, selected for the analysis of the external environment of an enterprise. We believe that the greater the value of  $Kc_i$ , the higher the level of complexity of the specific component. The coefficient of complexity is in the range from 0 to 1. The coefficient of complexity is determined from the data and listed in Table 3.

2. The interdependence of the factors of the  $i^{\text{th}}$  component of the external environment ( $Kint_i$ ) is determined based on the Spearman rank correlation coefficient. According to the scientists, rank correlation methods are often used specifically for the processing of sociological research (questionnaires), ratings, expert assessments, in particular, the Spearman and Kendall rank correlation coefficient [9, p. 140—141]. Spearman rank correlation coefficient is used to close the relationship between quantitative and qualitative characteristics if their values are ranked.

Calculation of the coefficient is comprised of the following stages:

1. Ranking of characteristics in ascending order.
2. Determining the rank difference of every pair of compared values,  $d = d_x - d_y$ .
3. Reduction to the square of the difference  $d_i$  and establishing the total amount,  $\sum d^2$ .
4. Calculation of the correlation coefficient of ranks according to formula (2).

$$p = 1 - 6 \frac{\sum d^2}{n^3 - n}, \quad (2)$$

where  $d^2$  — squares of differences between ranks;

$n$  is the number of characteristics included in the ranking.

With the help of the service (URL: <http://math.semestr.ru/corel/spirmen.php>):

- let's calculate Spearman's rank correlation;
- let's calculate the confidence interval for the coefficient and estimate its significance.

Qualitative characteristics of the closeness of the bond of the rank correlation coefficient, and other correlation coefficients, can be assessed by the Chaddock scale (Table 1). The rank correlation coefficient can be from -1 to +1:  $p = 1$  means there can be a direct bond,  $p = -1$  means there can be a reverse bond.

Table 1

**Gradation of bond density in-between phenomena on the Chaddock scale**

Characteristics of bond density	Weak	Moderate	Notable	High	Very high
The value of the correlation coefficient	0.1—0.3	0.3—0.5	0.5—0.7	0.7—0.9	0.9—1

Source. [9].

The coefficient of the interdependence of factors within a specific component of the external environment is determined based on statistical data. The final calculations are given in the Table 2.

Table 2

**Determination of weight coefficients of environmental components**

	Social-demographic component	Technological component	Economic component	Environmental component	Political component	Legal component	Ethical component	Sum of scores	Weight coefficient of the components
Social-demographic component	1	1/4	1/4	3	1/4	1/4	3	7	0.09
Technological component	4	1	1	2	4	2	4	18	0.23
Economic component	4	1	1	4	2	2	3	17	0.22
Environmental component	1/3	1/2	1/4	1	1/3	1/3	3	5.75	0.07
Political component	4	1/4	1/2	3	1	1/2	3	12.25	0.16
Legal component	4	1/2	1/2	3	2	1	4	15	0.19
Ethical component	1/3	1/4	1/3	1/3	1/3	1/4	1	2.83	0.04
							Sum	77.83	1.00

Source: formed by the author.

1. The variability of the factors of the  $i^{\text{th}}$  component can be determined based on the use of the acceleration coefficient [8, p.6] provided that the factor has a positive dynamics, formula (3):

$$Kv_i = \sqrt[n]{I_1 \cdot I_2 \cdot \dots \cdot I_n} \quad (3)$$

where  $Kv_i$  is the coefficient of variability of factors within a specific component of the external environment;

$I_1, I_2, I_n$  are the chain indices of acceleration of the studied indicators;

$n$  is the number of acceleration indices. In the case when there is a slowdown in the indicator, the value of the index in the calculation formula is taken into account modulo.

Other authors determine the level of variability of factors based on indicators of variation. Let's determine the level of variability of every factor based on initial data, enter some of the indicators of variation, use the average value of the oscillation coefficient in determining the level of variability of factors within a component. The oscillation coefficient shows the ratio of the range of variation and arithmetic mean.

Then, we compare the results of the level of instability of factors of the external environment, taking into account the acceleration coefficient or oscillation coefficient as a measure of the variability of factors of the external environment (see Tables 1—3).

Table 3

**Result to assess the level of instability of the external environment of the GTC today**

The component of the external environment	Criteria of instability of factors of components of the external environment of GTC (as of today)				Integral indicator of instability of the component	The level of instability
	I Criterion of complexity	II Criterion of interrelation	III Criterion of variability	IV Criterion of uncertainty		
1. Social-demographic component	0.167	0.7	0.470	0.47	0.45	relatively stable
2. Technological component	0.148	0.872	0.596	0.37	0.50	relatively unstable
3. Economic component	0.222	0.712	1,580	0.28	0.70	relatively unstable
4. Ecological (natural-geographical) component	0.167	0.894	0.650	0.12	0.46	relatively stable
5. Political component	0.093	0.883	2,980	0.10	1.00	highly unstable
6. Legal component	0.093	0.7	0.320	0.33	0.36	relatively stable
7. Ethical component	0.111	0.2	0.320	0.30	0.23	relatively stable
Total impact					<b>0.58</b>	<b>relatively unstable</b>

Source: generated by the authors.

Uncertainty of the factors of the  $i^{th}$  component is determined by the formula (4). Since the term «uncertainty» refers to lack of certainty about something, with for the factors of the external, proceeding from the fact that the results of an expert survey conducted to diagnose the impact of factors of the external environment on the operation of GTC are the initial data for assessing instability of the external environment, we believe that the level of discrepancy in the experts' opinions concerning strength and direction of every specific factor and will form the level of uncertainty of this factor, and together — the level of uncertainty of the factors of every component. Insufficient available information about one or another factor, inability to obtain reliable and complete information are the reasons for the experts' doubt, which will be reflected in the level of discrepancy in their opinions about the change of a factor, and, most importantly, impact on the company. Therefore, if we use the concordance coefficient when analyzing the level of consistency of experts, one can assume that the level of the inconsistency of experts will be the «1-concordance coefficient», which will quantify the level of uncertainty in the impact on the operation and development of an enterprise), *Table 1*.

$$Kunc_i = 1 - K_{coni} \tag{4}$$

where  $K_{coni}$  is the coefficient of (concordance) consistency of experts' opinions on the characteristics of the factors and the  $i^{th}$  component.

Having received values of indicators of  $i$   $K_v$  instability of factors of every component of the external environment concerning four criteria we will define, the overall level of instability of factors of every component of the external environment of an enterprise. We will take the measure of instability proposed by R. Duncan, which takes into account the uncertainty, dynamics, and complexity of the external environment and is determined by the formula (5) as a basis:

$$N = \frac{n_1 + n_2 + n_3}{3} \tag{5}$$

where  $N$  is the overall level of instability of the external environment;

$n_1, n_2, n_3$  are respective levels of uncertainty, dynamics, and complexity of the external environment [5, p. 314].

Then we will estimate the overall level of instability of the factors of each component of the environment ( $N_{ci}$ ) in our case by formula (6):

$$N_{ci} = \frac{K_{ci} + K_{vi} + K_{unti} + K_{inti}}{4} \quad (6)$$

To identify the levels of instability of factors of the external environment, let's use the scale proposed by S. Komarinets [11, p. 224]:

- 0.00—0.24 — stable environment with homogeneous, predictable factors;
- 0.25—0.49 — relatively stable environment, some unpredictable factors;
- 0.50—0.69 — relatively unstable environment — an environment of medium level of uncertainty, interdependence, complexity, and variability;
- 0.70—0.87 — unstable environment — uncertain, dynamic, and complex environment;
- 0.88—1.00 — highly unstable environment — completely indefinite highly variable and extremely complex environment.

The integrated level of instability of the external environment is determined by the formula (7):

$$N = \sum_{i=1}^n K_{ci} \cdot N_{ci} \quad (7)$$

where  $K_{ci}$  is the significance coefficient of the  $i^{\text{th}}$  component of the external environment;

$n$  is the number of components of the external environment.

Let's determine the significance coefficient of either component of the environment with the use of the method of pairwise comparison.

Let's illustrate the matrix for assessing the instability of factors of the external environment in terms of specific components, built on the use of an integrated approach, which revealed the instability of specific components (economic, political, social-demographic, etc.) concerning four criteria of instability (complexity, interdependence, variability, uncertainty) [6—11] in *Fig. 1*.

**Results.** Based on the data obtained from the processing of questionnaires, actual and forecast values of indicators that reflect environmental factors (social-demographic, technological, economic, environmental (natural-geographical), political, legal, and ethical components) and the proposed method of assessing the instability of the external environment, we shall assess the level of instability of the external environment of the GTC (gas transmission companies). *Table 3* presents the results of assessing the level of instability of the external environment of the GTC today, *table 4* presents forecast value in 2—3 years, graphically — in *Fig. 2*.

Based on the results of the study of instability of the external environment concerning four criteria in terms of components, it can be argued that the economic component, caused by a variety of economic factors that affect the functioning and development of GTC is the most complex. Regarding the relationship of factors, based on the Chaddock scale and results obtained, the factors of all components, except ethical, are highly interrelated. The most variable is the factors of political and economic components from the standpoint of perception of their variability in the development of GTC. Factors of environmental and technological components are also highly variable. The factors of social-demographic and ethical components are the most stable concerning GTC. As for the level of uncertainty, the factors of social-demographic, ethical, legal, and technological components are the most uncertain. However, it is most accurate to forecast and determine the effects of environmental and political components. In general, today the political component is highly unstable, the technological and economic components of the environment due to the factors that reflect them are relatively unstable concerning the operation of the GTC. In general, the external environment is assessed as relatively unstable concerning the functioning of the GTC of Ukraine.

Configurations of values of criterion coefficients of instability	Criteria for instability of factors of components of the external environmental				Interpretation of configurations of coefficients of instability of factors of the external environment in terms of specific components	Characteristics of the level of instability
	Complexity	Interdependence	Variability	Uncertainty		
simple $0 < K_c \leq 0.2$	weak $0 < K_{int} \leq 0.3$	low $0 < K_v \leq 0.2$	low $0 < K_{unc} \leq 0.5$		The small number of factors that are weakly correlated with each other do not change and are well defined	stable
	moderate $0.3 < K_{int} \leq 0.5$	relatively low $0.2 < K_v \leq 0.4$				
complex $0.2 < K_c$	noticeable $0.5 < K_{int} \leq 0.7$	average $0.4 < K_v \leq 0.8$	average $0.5 < K_{unc} \leq 0.8$		The relatively large number of factors that are markedly interdependent, quite variable, and for various reasons insufficiently defined	relatively unstable
	high $0.7 < K_{int} \leq 0.9$	relatively high $0.8 < K_v \leq 1$	high $0.8 < K_{unc} \leq 1$			
	very high $0.9 < K_{int} \leq 1$	high $1 < K_v$			A large number of factors that are quite interdependent, variable, and virtually unpredictable	unstable
					A large number of largely interdependent factors are changing rapidly, almost unpredictable	highly unstable

Fig. 2. Matrix for estimating the instability of environmental factors in terms of components

Source: developed by the author based on sources [6—11].

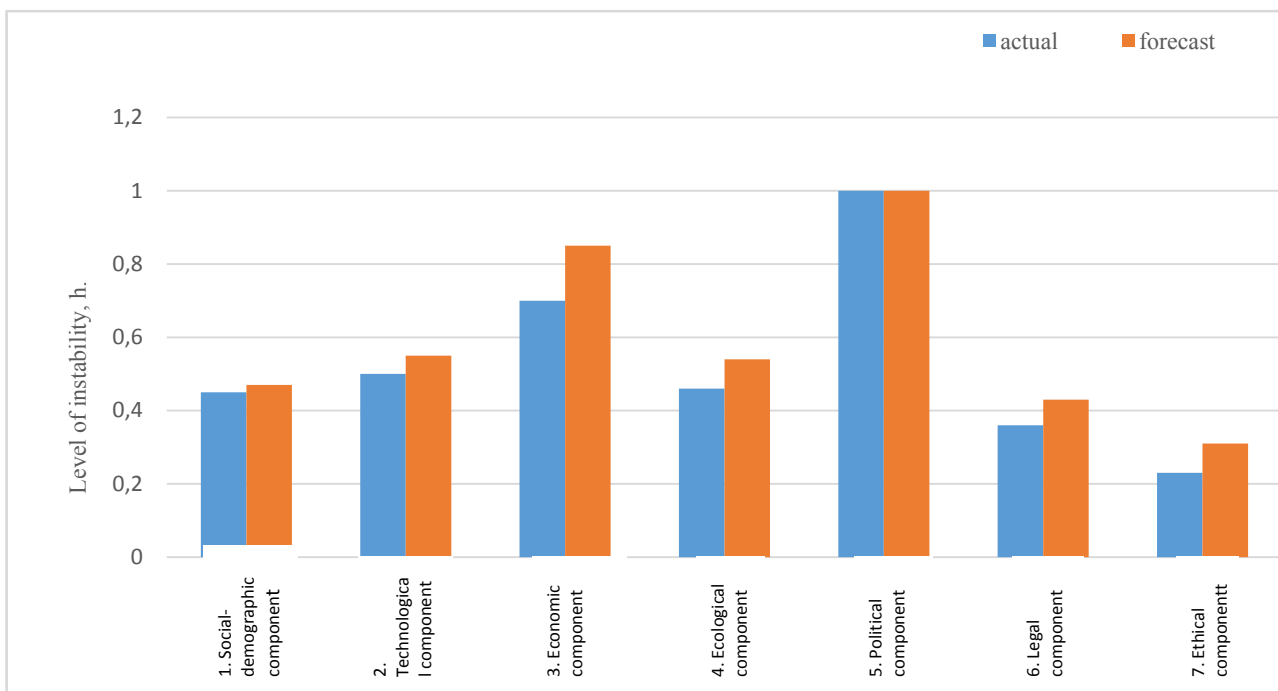
Table 4

**The results of forecasting the level of instability of the external environment of the GTC in 2—3 years**

The component of the external environment	Criteria of instability of factors of components of the external environment of GTC (forecast)				An integral indicator of the instability of the factors of the component	The level of instability
	I Criterion of complexity	II Criterion of interrelation	III Criterion of variability	IV Criterion of uncertainty		
1. Social-demographic component	0.167	0.7	0.610	0.41	0.47	relatively stable
2. Technological component	0.148	0.872	0.895	0.30	0.55	relatively unstable
3. Economic component	0.222	0.712	2.056	0.39	0.85	unstable
4. Ecological (natural-geographical) component	0.167	0.894	0.980	0.11	0.54	relatively unstable
5. Political component	0.093	0.883	3.210	0.18	1.00	highly unstable
6. Legal component	0.093	0.7	0.510	0.42	0.43	relatively stable
7. Ethical component	0.111	0.2	0.455	0.49	0.31	relatively stable
<b>Total impact</b>					<b>0.65</b>	<b>relatively unstable</b>

Source: generated by the authors.

Over the next 2—3 years, we should expect a relatively unstable environment for the operation of GTC, and the level of instability for all components will grow. Factors related to non-traditional elements of a hybrid war are forecast to be highly unstable, namely: political components, economic components — we see as unstable, factors of technological and environmental environment — relatively unstable. Social-demographic and political components are approaching the limit of relative instability.



**Fig. 3. Comparison of the instability of environmental factors of GTC operation in terms of components**

Source: built by the authors.

**Conclusions.** Based on the study, it can be argued that consideration of instability of the external environment concerning four criteria allowed a comprehensive approach to determining the level of instability and comprehensively assessing the sources of instability due to environmental factors. In addition, the assessment of instability in terms of environmental components makes it possible to identify specific factors that pose a threat in terms of the unpredictability of their changes. In particular, we note that the development and economic production of shale gas, development of technologies for the production of gas crystals from the seabed, geopolitical situation, the need to preserve the depleted hydrocarbons, development of alternative and renewable energy sources, application of new gas transportation technologies has significantly changed the geopolitical conditions of the gas market, in general, and Ukraine, in particular, caused changes in the external and internal environment of GTC. The aggravation of the political situation in the country and the world, and the high variability and unpredictability of changes in the factors of the economic component are significant sources of instability in the environment of GTC.

The proposed method of assessing the instability of the external environment, in contrast to existing ones, allows a comprehensive assessment of instability not only as a result of the variability of factors but takes into account their complexity, level of interconnectedness, and uncertainty. Moreover, a feature of the author's integrated approach to assessing the instability of the environment is to assess the instability of factors within individual components and take into account the importance of every component concerning the functioning and development of GTC, which is the basis for more pertinent results.

The system of measures that guarantee the security of entrepreneurial initiative and economic activity in the field of GTC, form a set of non-traditional components of hybrid war and directly affect the performance of enterprises. Hybrid war is multifaceted and can have a significant impact on the efficiency of business units. The economic sphere is the basic space in which close ties are formed between the external environment of an enterprise, which requires careful study in the short and long term.

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