Tools for Ensuring and Assessing the Economic Security of Enterprises of the Fuel and Energy Sector of the Northern Resource-Extracting Region Based on their Network Interaction

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Abstract
The article outlines the role of the economy of the northern resource-extracting regions in the system of national and economic security of the country, examines the current problems of the fuel and energy sector that pose threats to the economic security of enterprises of the fuel and energy sector of the northern resource-extracting region, as well as considers the need to apply new approaches to the issues of ensuring the economic security of enterprises. The reasons and advantages of using network interaction to neutralize the threats that have arisen in the industry are identified based on the abstract-logical approach. The expert assessments, as well as tools for ensuring the economic security of enterprises of the fuel and energy sector of the northern resource-extracting region, have been developed using the methods of statistical and economic analysis. This concerns the developed algorithm for assessing the economic security of an enterprise, a system of indicators, and threshold values for economic security, criteria for determining the level of economic security, and a corresponding conceptual model, allowing to quickly identify threats to the economic security of the internal environment, near and far environment (network), identify strategies and measures to maintain or improve economic security.

Key-words: Economic Security, Fuel And Energy Sector Enterprises, Economic Security Indicators, Threshold Values, Network Interaction, Inter-Firm Cooperation, Northern Resource-Extracting Regions, Economic Security Model.

1. Introduction

The global economic crisis caused by the coronavirus pandemic has jeopardized network interactions between enterprises in Russia and the world in general. As a result, the level of economic

security of enterprises, especially those that are deeply integrated into network interactions, has suffered greatly.

The problems of economic security in the system of enterprise-industry-region-state have led to the need to address issues related to forecasting risks and threats, creating mechanisms to counter threats, designing models for managing economic objects that would provide competitive advantages, and leveling adverse events in the real sector of the economy through the cooperation of economic entities of the value chain [Osipov, 2013].

Ensuring the economic security of enterprises of the fuel and energy sector (FES) in the northern resource-extracting regions, which act as a guarantor of the national, economic, and energy security of the country, is of particular relevance. In recent years, there has been a permanent threat of falling oil production in the northern territories, particularly, in the Khanty-Mansi Autonomous Okrug – Yugra (hereinafter – KhMAO-Yugra) – the oil base of the country, which produces about 4% of the global oil production volume and more than 40% of oil production in Russian. This threat is caused by the following conditions and factors [Bogomolova, Ustyuzhanceva, 2020; Larchenko, Kolesnikov, 2017; Islamutdinov, 2016].

the low share of innovation-active enterprises (about 6%);

deterioration of the quality of oil reserves;

reduction of investment volume;

imposition of international economic sanctions;

lack of in-house technologies for the development of hard-to-recover oil reserves and deposits of the Bazhenov formation;

reduced oil recovery rate;

the effect of institutional traps (investment, pseudo-innovation activity, catch-up development and copying, education, etc.).

Therefore, in the context of the qualitative complication of oil production, the transition to the development and production of new types of resources, an approach toward the development of northern resource-extracting regions based on the economically safe functioning of fuel and energy sector enterprises, as well as the need for specific regional innovations, whose development and implementation should be entrusted to the local innovation and scientific and educational complex, and the service sector [Kryukov, 2017], which is possible with a properly built system of relations.

Currently, one can observe a specific phenomenon which is the blurring of firm boundaries and their conditionality. This is due to the development of network forms of interaction as the most effective way to solve the problems of limited resources, rising costs, information asymmetry, and the rate of technological change [Pittaway, 2004; Castells, 1996]. Considering the identified problems of economic security of the fuel and energy sector enterprises of the KhMAO-Yugra, caused, among other things, by unfavorable natural and climatic conditions, transport and institutional remoteness, network interaction is one of the promising tools for maintaining the competitiveness and economic security of fuel and energy enterprises.

Thus, today's threats and challenges to the enterprises of the fuel and energy sector of the northern resource-extracting region determine the urgency of maintaining the economic security of the sector enterprises at a high level by developing tools to ensure it, considering the factors of network interaction.

2. Methods

To ensure economic security, one of the key objectives is to identify signs of weaknesses and strengths of the enterprise based on the assessment of changes in quantitative and qualitative indicators allowing getting the final result, that is, the level of economic security of the economic entity. To manage economic security, it is necessary to have a certain sample, comparing with which will allow drawing a conclusion about the current level of economic security of the company, and making appropriate managerial decisions, which is based on the use of the integrated assessment method.

According to S.V. Kazantsev, Professor of Economics, the assessment of the level of security of the object is "determining the measure of proximity of the actual state of this object to the state of its complete security". The lack of quantitative and qualitative indicators of economic security makes it impossible to monitor and reflect the implementation of certain priorities [Gorodetsky, 2017]. The problems of determining economic security at any level "need to determine the boundaries of the safe functioning of the system and develop threshold values that would allow assessing the maximum level of changes in its parameters, beyond which there are dangers in a particular field..." [Mityakov, 2017].

Indicators are a key tool for identifying possible threats and risks and contain thresholds, failure to comply with which leads to the formation of negative trends, and the weakening of the level of economic security of the enterprise. The upper and lower limits of the threshold level create a "security corridor" [Pozdeyev, 2015], the exit from which requires prompt action.

According to the works of Professor of Economics V.K. Senchagov, threshold values are understood as "limit values, whose ignoring prevents the normal development of the economy... and leads to the formation of destructive trends in the field of production...". They must be used to "separate the normal level of economic security from the insufficient one. The greater the degree of failure of the indicator to reach the threshold value, the greater is the level of risk, and the lower is the protection from possible threats" [Senchagov, 2012]. Therefore, the use of the indicator approach allows determining the deviation of economic security indicators from the threshold values, which serve as indicators of possible threats.

Since the indicative analysis serves as the basis for methodological approaches to economic security, important is to justify the threshold values of the economic security components that indicate the transition from a safe state of the system to a dangerous one. The threshold values of economic security indicators are based on the proactive nature of threats since one of the main goals of economic security is to ensure preventive measures to neutralize possible negative events. Limit values can describe the desired state of the economic system at the reporting date, whose achievement will indicate the stability and efficiency of the enterprise, or represent the value, proposed and supported by most experts, and characterizing the "breaking point" [Vissarionov, Gumerov, 2017], beyond which adverse consequences may appear in the form of crisis developments, reduced competitiveness, and loss of development opportunities.

The quantitative assessment of economic security based on the indicator approach was first applied at the state level and the regional level. For example, the indicators and threshold values of the region proposed in the article [Rudenko et al., 2019] were based on the theoretical and practical developments of the Professor of Economics S.Yu. Glazyev dealt with the assessment of the country's economic security. Then this approach was applied to economic entities. Thus, some authors [Samochkin, Barakhov, 2014] propose to assess the economic security of an economic entity by three groups of indicators, namely, production, financial-and-economic, and social. The authors of the work [Gaifullina, Khaliullina, Hafizova, 2017] have developed indicators and thresholds for the economic security of oil and gas extracting enterprises, considering industry specifics.

3. Results

Based on the studies discussed above, we propose tools for ensuring economic security for enterprises of the fuel and energy sector of the northern resource-extracting region, considering the specifics of the industry and the factors of network interaction, particularly, a system of indicators for assessing economic security, threshold values, as well as an algorithm and a conceptual model for ensuring economic security of economic entities.

The algorithm for conducting a comprehensive assessment of the economic security of a fuel and energy sector enterprise based on network interaction is presented in Fig. 1 and includes six stages.

Fig. 1 - Algorithm for conducting a comprehensive assessment of the economic security (ES) of the fuel and energy sector enterprise of the northern resource-extracting region based on network interaction (compiled by the authors)
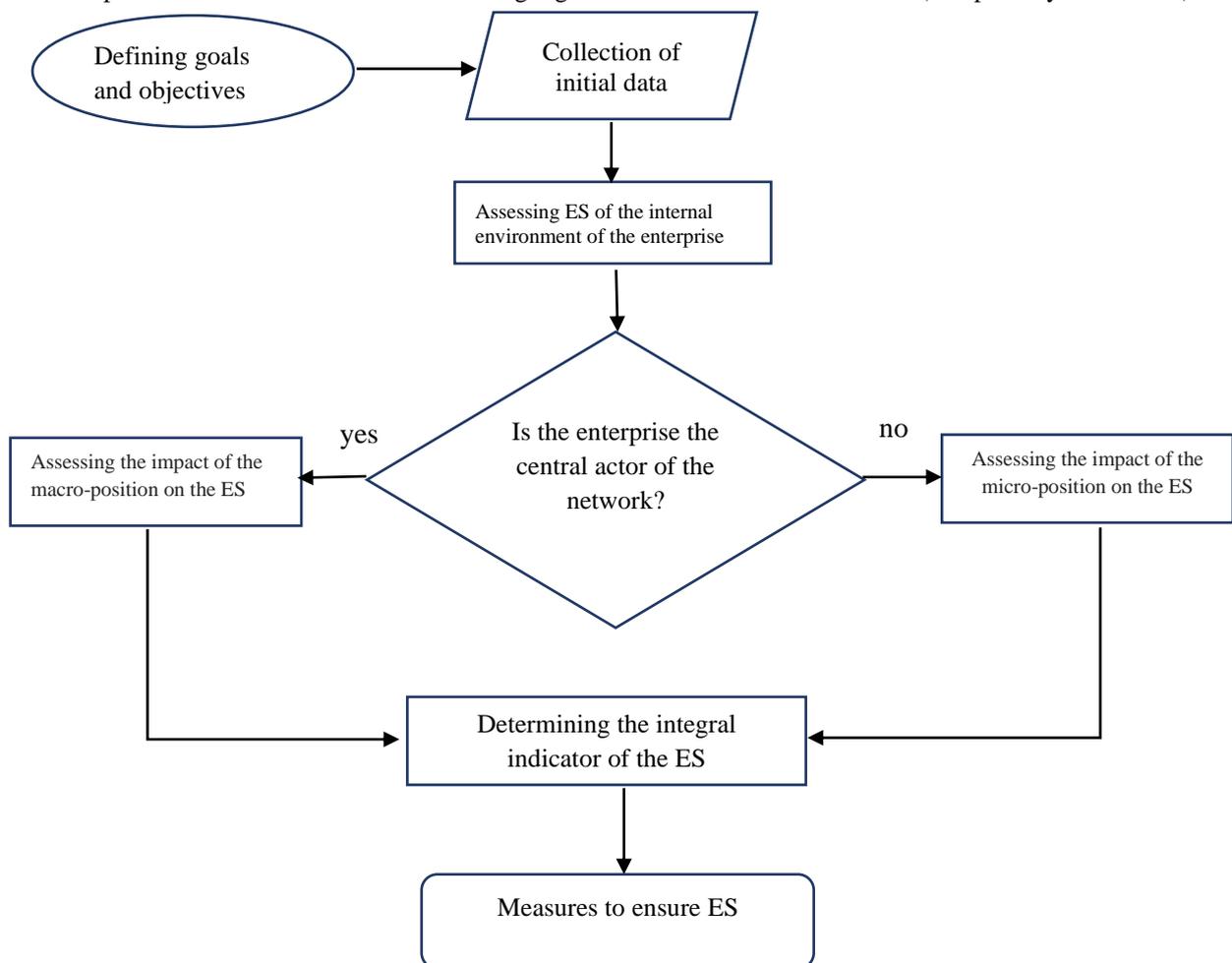
Stage 1. Defining the objectives of conducting the integrated assessment. As a rule, the purpose of the economic security assessment is to reveal the weaknesses, problems, and risks of the enterprise, and determine the directions for their prevention and elimination. In the network approach, listed goals are supplemented by the identification of favorable development opportunities, which are the most significant characteristic of the network.

Stage 2. Searching and collecting the necessary accounting information (operational, accounting, and statistical), including with the involvement of experts, it's processing (bringing it into a comparable form) for further evaluation.

Stage 3. Assessing the level of economic security of the internal environment of the enterprise without considering the influence of network factors. Calculating qualitative and quantitative indicators of economic security, analyzing and interpreting the obtained values.

At this stage, it is proposed to use the developed system of indicators for assessing the economic security of the internal environment of the fuel and energy sector enterprise, consisting of six indicator blocks, and including threshold values (Table 1).

Table 1 - The system of the economic security indicators of the internal environment of the fuel and energy sector enterprise of the northern resource-extracting region (without considering network factors)

No	Indicator	Threshold value
Financial block		
1.	Equity to total assets ratio	≥ 0.5
2.	Debt ratio	≤ 0.7
3.	Current liquidity ratio	≥ 2
4.	Rate of return (Operating margin)	≥ 0.15
Production and sales block		
5.	Receivables and payables ratio	3
6.	Growth rate of return on assets	>100
7.	Profitability of sales	>0.2
8.	Capital turnover ratio (activity ratio)	>0.5
Resource block		
9.	Investment ratio	≥ 0.6
10.	Depreciation rate of fixed assets	≤ 0.35
11.	Asset growth rate	$\geq 100\%$
12.	Ratio of fixed assets renewal and disposal coefficients	≥ 1

Personnel block		
13.	Employee turnover rate	<5%
14.	Educational level indicator	≥80%
15.	Salary level	≥1.5
16.	Internal mobility ratio	≥10%
Ecological block		
17.	Availability of a policy (or another document) on interaction with the indigenous small-numbered peoples of the North	1 (Yes – 1 No – 0)
18.	Exceeding the maximum standards of water pollution	1 (Yes – 0, No – 1)
19.	Paying fines for environmental offenses in the absence of expenses for environmental protection measures	1 (Yes – 0, No – 1)
20.	Exceeding the maximum standards of atmospheric pollution	1 (Yes – 0, No – 1)
Energy block		
21.	Uninterrupted energy supply	1 (Yes – 1 No – 0)
22.	Specific energy consumption of the enterprise's products	≤3%
23.	Share of the energy component in the cost of production for energy security	≤3%
24.	Availability and implementation of the energy-saving and energy efficiency improvement program	1 (Yes – 1 No – 0)

Source: Compiled by the authors using the works [Gaifullina, Khaliullina, Hafizova, 2017; Ovechkina, 2013]

The assessment of the economic security of the internal environment of the enterprise (without considering network factors) is carried out based on the indicator approach and includes the following stages:

Calculating indicators that characterize various types of enterprise security.

Determining the threshold value for each indicator.

Calculating deviation degree of the actual value of each indicator from the threshold. If the indicator's optimization tends to increase, then the actual indicator is divided by the threshold. Otherwise, the threshold indicator is divided by the actual one. To ensure that a particular indicator does not overestimate or underestimate the level of economic security, the following is suggested:

if the actual value exceeds 1, a value equal to 1 is taken in the calculation;

if the indicator has a negative value, a value equal to 0 is taken in the calculation.

4. The level of each of the economic security blocks (S) is calculated using the formula (1):

$$S_t = \frac{\sum_{i=1}^{n}(x_i \times r_x)}{n}, \qquad (1)$$

where x_i is the indicator value; t is the security block; r_x is the weight coefficient of the indicator in the evaluation block; n is the number of indicators reflecting a particular type of enterprise security.

The closer is the value of S_t to 1, the higher the level of a particular type of economic security of the enterprise.

5. The level of economic security of the internal environment of the fuel and energy sector enterprise (without considering the influence of network factors) is determined by the formula (2):

$$ES = \sum_{t=1}^{N} S_t, \qquad\qquad (2)$$

where ES is the level of economic security of the fuel and energy sector enterprise; N is the number of security types.

To determine the level of economic security of the fuel and energy sector enterprise without considering the influence of network factors, the following criteria ranges were proposed:

- [0.75; 1] – a high level of economic security; the main part of the indicators reached the threshold values or exceeded them towards improvement; economic security should be maintained at this level;
- [0.5; 0.75) – the average level of economic security; some indicators have reached the threshold values, while some have exceeded their limits towards deterioration; the enterprise needs to apply measures in the near future to eliminate threats to certain types of security;
- [0,25; 0,5) – low level of economic security; all or most of the indicators are below the threshold values or have exceeded the limits towards deterioration; the company needs urgent measures to eliminate threats to certain types of security;
- (0; 0.25) – lack of economic security.

Stage 4. Determining the enterprise's status in the network and assessing the impact of network interaction on economic security.

The authors' analysis of the inter-firm interaction theory [Granovetter, 1973; Hakansson H., Johanson J., 1993] has shown that each enterprise as a business entity has a "strategic identity", whose formation is the result of enterprise role and its relationships with network agents. Without an interactive environment, an enterprise loses its uniqueness, which is manifested in its "attractiveness" for a particular counterparty, due to the system of connections, actions, and resources of business

partners. Therefore, the assessment of the economic security of an enterprise in the current context cannot be carried out separately from the network context. At that, it was revealed that in the network context, two status hierarchies in the network can be distinguished that need to be taken into account when assessing network interaction.

A) Macro position in the network determines the status of the central actor in the network and depends on:

the uniqueness of network agents (direct and indirect);

the role of the central actor in the network;

strength of relationships with network members;

the ability to connect through resources, and activities with other businesses.

The macro position of the enterprise is typical for vertically integrated oil companies, around which the rest of the industry's enterprises are concentrated.

The indicators for assessing the macro position of the enterprise in the network are presented in Table 2.

Table 2 - The system of indicators for assessing the macro position of the fuel and energy sector enterprise (the central actor of the network)

No	Group (block) of indicators	Indicators
1.	Block for assessing network configuration parameters	- network density; -the degree of communication intensity between network partners; - the degree of diversity of network participants; - the degree of the actor's centralization.
2.	Management distance assessment block	- transparency of corporate information; - providing mutual assistance on a formal basis; - providing mutual assistance on an informal basis; - the level of trust between network partners.
3.	Block for assessing the level of cooperation	- development of joint projects; - the propensity of network participants to innovate; - common interests and goals; - the duration and stability of the network participants' relationships.
4.	Block for assessing the profitability of relationships	- sales volume dynamics (growth rate); - the degree of satisfaction with the network interaction; - access to unique resources; - improving/maintaining the market position.

Source: Compiled by the authors

B) Micro position reflects the position of the enterprise with respect to the central network actor. The factors, determining the micro position of the company include:

the degree of the relationship firmness with the central partner of the network;

the uniqueness of the central partner of inter-firm interaction;

resource allocation efficiency;

the competitiveness of the enterprise relative to other economic entities in the network.

The indicators for assessing the micro position of the enterprise with respect to the central agent are presented in Table 3.

Table 3 - The system of indicators for assessing the micro position of the fuel and energy sector enterprise

No	Group (block) of indicators	Indicators
1.	Loyalty and commitment assessment block	- providing discounts; - convenience of the payment system; - providing payment deferrals; - providing the ability to change the product, the terms of its delivery, work performance, and rendering services at the request of the counterparty.
2.	Block for assessing the power of influence (degree of dependence) of the supplier/buyer	- the uniqueness of the product, works, and services; - obtaining/granting loans; - the quality level of products (works, services); - the complexity of replacing the supplier (buyer).
3.	Block for assessing the coordination level of network agents' actions	- ensuring fast and accurate response to requests; - executing the contract terms; - distributing risks on transactions.
4.	Block for assessing the stability of mutual relationships	- the review period of the contract terms; - terms of contract validity; - the duration of the mutual relationships.

Source: Compiled by the authors

The network factors of each block are assessed using the formula (3):

$$B_i = \sum_{x=1}^{n} \left(\frac{p_x}{p_x^n} \times r_x \right) \div n \qquad (3)$$

where B_i is the degree of influence of individual block on the enterprise's position in the network; p_x is the actual value of the assessment block indicator; p_x^n is the threshold value of the assessment block indicator; n is the number of indicators in the assessment block; r_x is the indicator weight coefficient in the assessment block; i is the number of blocks.

The final value of the assessment of the macro or micro position of the enterprise is determined by the formula (4) as the sum of all the values of the blocks:

$$NW_{ES} = \sum_{i=1}^{n} B_i \qquad (4)$$

where NW_{ES} is the coefficient of the degree of influence of the determinants of macro or micro position in the network on the economic security of the enterprise; n is the number of aggregated blocks of indicators.

Threshold values of indicators of macro and micro position of the enterprise, weight coefficients, as well as testing of methodological tools are published by the authors in their work [Ustyuzhantseva, Islamutdinov, 2020].

Stage 5. Calculating the integral indicator of the economic security of the fuel and energy sector enterprise of the northern resource-extracting region, considering the influence of network factors.

A comprehensive assessment of the level of economic security of the fuel and energy sector enterprise of the northern resource-extracting region within the framework of the proposed network approach is determined by multiplying the obtained value of the coefficient reflecting the influence of the determinants of the enterprise's position in the network on its economic security by the indicator of economic security of the enterprise's internal environment according to the formula (5):

$$ES_C = ES \times NW_{ES} \qquad (5)$$

where ES_C is the level of economic security of the fuel and energy sector enterprise, considering the network context; ES is the level of economic security of the internal environment of the enterprise; NW_{ES} the coefficient reflecting the degree of influence of the macro or micro position determinants of the enterprise on its economic security.

Stage 6. The final stage in the comprehensive assessment is defying measures to ensure economic security, preparing proposals to eliminate the identified negative phenomena, and outlining the necessary compensation reserves in the event of the implementation of critical risks. The interpretation of the results of the assessment of the level of economic security is carried out based on a 3-point scale presented in Table 4.

Table 4 - Gradation of the economic security levels of the fuel and energy sector enterprise of the northern resource-extracting region, considering network interaction

No	Range of the integral indicator values	Description of the economic security level	Response measures
1.	Below 0.5	A dangerous level of economic security. The company has a low level of economic security and occupies a weak position in the network.	Searching and building relationships with new counterparties that have a high level of economic security based on the results of a preliminary assessment, establishing new contacts, increasing the importance of a particular buyer's/supplier's activity.
2.	From 0.5 to 0,75	An alarming level of economic security. The company has a medium or high level of economic security and an average position in the network.	Conducting resource analysis (VRIO), externalizing idle resources and capabilities, concentrating and developing key resources that provide a competitive advantage.
3.	Above 0.75	A stable level of economic security. The company has a high level of economic security, a strong position in the network.	Holding a position in the network, maintaining connections with existing network agents.

Source: Compiled by the authors

Development of tools for ensuring the economic security of the fuel and energy sector enterprises of the northern resource-extracting region, as well as the dependence of the implementation of strategic development directions of raw materials regions on the consistency of the activities of the industrial enterprises of the northern resource-extracting region, as well as the level of their economic security, predetermined the creation of a conceptual model for ensuring the economic security of the fuel and energy sector enterprises of the northern resource-extracting region(Fig. 2). This model reflects the relationship of the economic security of the enterprises' internal environment with the network context (the near environment) and the network horizon (the far environment, containing potential counterparties).

Fig. 2 – A conceptual model for ensuring the economic security of enterprises (EES) of the fuel and energy sector based on network interaction (compiled by the authors)
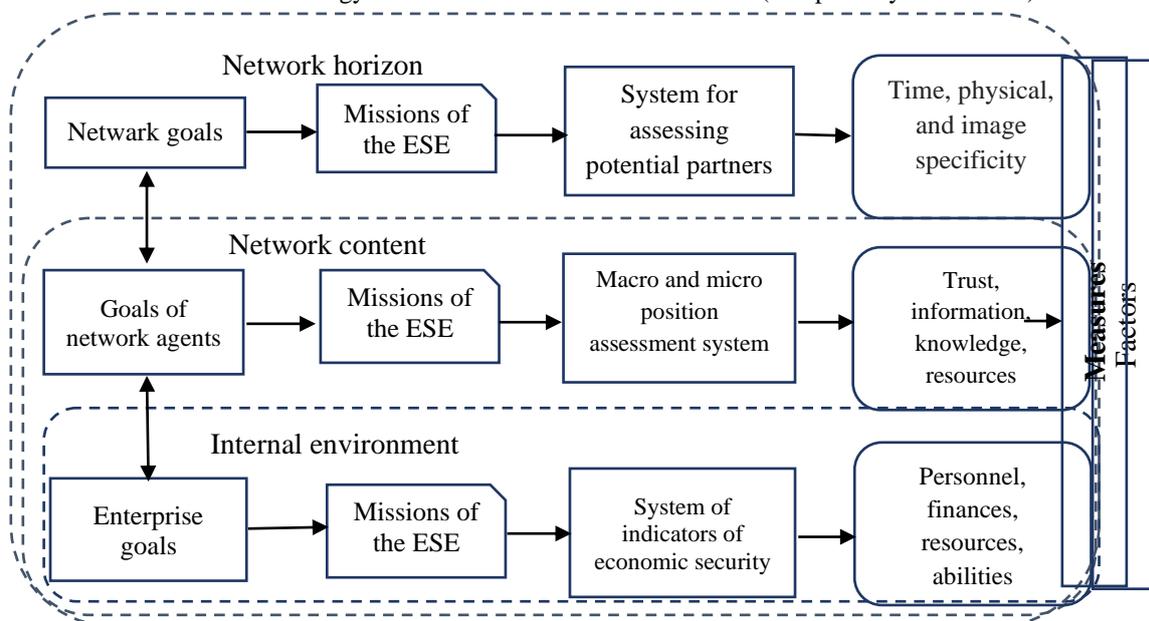
First of all, to achieve the strategic goals of the industry and the northern resource-extracting region, the most important thing in the network approach is to integrate the goals of network participants who possess a "strategic identity" and use long-term connections to gain advantages. At the same time, these goals should not contradict the goals of the economic security system of an individual enterprise.

Further, the tasks, aimed at increasing or maintaining the level of economic security of the company are formulated. At the internal environment level, these include managing the risks of

causing damage by timely identifying threats, determining the reasons for their possible implementation, taking measures to neutralize them, predicting trends in the enterprise and the industry development, including through the active participation of the enterprise in creating and regulating the network context in which the enterprise operates. These problems are solved by assessing the level of internal economic security of the enterprise employing six key components. The results of the assessment allow formulating a list of measures considering the enterprise's existing capabilities (factors).

Within the network context, the range of tasks expands and is associated with the assessment of inter-firm interaction either with the central partner (micro position) or with all the counterparties included in the network context of the central agent (macro position). The methodology for assessing the micro position of an enterprise includes 4 blocks of indicators that allow analyzing the role of the central network agent in the activities of other enterprises, the stability of interaction, as well as the level of coordination on formal and informal issues. The macro position of the firm in the network reflects the role of the enterprises included in the network in the activities of the central agent by analyzing the network configuration parameters, the availability of joint design solutions, and obtaining benefits from the organization of inter-firm cooperation.

Based on the assessment of the impact of network factors on the level of economic security of the enterprise, measures are formulated depending on the level of position in the network, considering the main factors of network cooperation, such as the level of trust, responsiveness, volume and variety of information received, and the value and rarity of resources.

A distinctive feature of the network approach is the shift of the enterprises' spectrum of attention from corporate resources to the opportunities provided by the network environment. Accordingly, the tasks that can increase the level of economic security of the fuel and energy sector enterprises consist in searching for new partners, establishing and strengthening cooperation with network agents of the network horizon and their transfer to the network context. To reduce the risks of attracting unreliable partners, it is proposed to conduct a preliminary assessment of the economic security of a potential counterparty based on five blocks of indicators, namely, identifying registration and address, checking financial solvency, business reputation, and identifying the founders. Based on the obtained checking results, one of the following decisions is made:

starting cooperation;

conducting additional analysis of the counterparty's activities,

refusing cooperation.

Development of measures for building relationships is carried out based on the tasks and obtained positive assessments considering the following factors:

timeframe specificity (the importance of just-in-time deliveries);

physical specificity (access to equipment and assets);

image specificity (reputation).

The degree of involvement of the enterprise in the network allows reducing the uncertainty of the environment by timely obtaining information about possible threats and future trends (the field of unpredictable alternatives).

It should be noted that the success of the fuel and energy sector enterprises of the northern resource-extracting region and their economic security depends not only on the interaction in the network but also on the conditions imposed by the external environment, such as financial, personnel, institutional, technological and territorial, of which some can be regulated with properly built relationships in inter-firm network structures.

4. Conclusion

The current status of the fuel and energy sector of the northern resource-extracting region, as well as the identified threats and challenges to the economic security of its enterprises, have led to the need to shift the attention of researchers from protecting assets (resources) to obtaining benefits from network interaction. It was revealed that the enterprises of the fuel and energy sector of the northern resource-extracting region need to change the existing strategies towards interaction with economic entities both within the industry and in other industries by forming common business networks that would allow accessing new resources controlled by other enterprises, sharing technologies, and implementing innovative projects.

Considering the network interaction factors, caused by the trends of the conventionality of corporate boundaries and increasing competition, tools for ensuring the economic security of enterprises of the fuel and energy sector of the northern resource-extracting region were proposed. These tools include an algorithm for assessing economic security, a system of economic security indicators of the internal environment, gradation of the economic security levels of the enterprise and interpretation of the results, a conceptual model for ensuring the economic security of enterprises,

reflecting the relationship of the economic security of the internal environment of the enterprise with its network context and network horizon, as well as the mutual influence of their goals, objectives, and evaluation results. The proposed tools allow subsequently developing measures to prevent and neutralize threats and building productive inter-company relations.

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