CHOOSING AN ORGANIZATIONAL AND ECONOMIC MECHANISM TO ENSURE THE FINANCIAL SECURITY OF GAS DISTRIBUTION COMPANIES

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The purpose of the article is to develop a scientific and methodological approach to the selection of an organizational and economic mechanism for ensuring the financial security of gas distribution enterprises, which takes into account the combination of their status as natural monopoly entities and enterprises, and to substantiate practical recommendations for its implementation.

A set of methods of scientific cognition was used, namely: the fundamental provisions of the theory of finance, probability theory and mathematical statistics, and the method of adaptive forecasting.

A scientific and methodological approach to the selection of an organizational and economic mechanism for ensuring the financial security of gas distribution enterprises is proposed, which, unlike the existing ones, is aimed at consistent and targeted implementation of a set of preventive, stabilization and radical measures, which allows for the prevention of financial danger, timely assessment, forecasting its level, as well as developing, implementing an appropriate program and monitoring its implementation.

The implementation of the proposed scientific and methodological approach in the practical activities of gas distribution enterprises involves the preparation of substantive information, analytical and methodological support, which consists in a comprehensive analysis of financial security.

Keywords*:* gas distribution companies, financial security, capital flow, threats, organizational and economic mechanism, adaptive forecasting.

1. Introduction

The fundamental changes in the natural gas market associated with the implementation of the requirements of the EU's Third Energy Package affect the activities of each market participant, including those of gas distribution companies.

The current conditions of functioning of gas distribution companies, namely, the presence of regulatory restrictions in determining tariff levels, which narrows the range of tools available to the management of enterprises to ensure the efficiency of functioning, the high social significance of these entities, trends in the implementation of energy efficiency programs and unsatisfactory financial condition, necessitate the diagnosis of problems of activity, identification of the most significant factors influencing its results, formation of forecasts for the development of gas distribution companies.

2. Literature review

Approaches to assessing the financial security of enterprises, the issues of methodology for forming a mechanism for ensuring their efficiency were considered in the scientific works of Ukrainian authors such as: G. M. Azarenkova (2006), O. I. Baranovsky (2009), T. G. Vasyltsiv (2012), O. I. Vivchar (2019), V. V. Lukyanova & Y. V. Shutyak (2013), S. I. Melnyk (2020), O. V. Nusinova (2011), A. S. Poltorak (2019), O. V. Susidenko (2015), A. V. Cherep (2013), O. V. Cherevko (2019), T. V. Momot (2015).

The following scholars have made a scientific contribution to the study of the functioning of natural monopolies in the oil and gas industry: V. B. Kropyvnytska & D. Magas (2022a), Y.A. Slyusarenko (2021), I. Chukaieva (2021). The following scientists have studied the issues of assessing the efficiency of gas distribution enterprises and developing recommendations for the formation of their development strategy: R. V. Mann et al. (2022), V. A. Topylo (2022), Z. M. Matsuk (2021).

The purpose of the article is to develop a scientific and methodological approach to the choice of an organizational and economic mechanism for ensuring the financial security of gas distribution enterprises, which takes into account the combination of their status as natural monopoly entities and enterprises, and to substantiate practical recommendations for its implementation.

3. Materials and Methods

A set of methods of scientific cognition was used to ensure the conceptual unity of the study. The methodological basis is the resource and functional approaches to the study of economic processes and phenomena, as well as the fundamental provisions of the theory of finance and probability theory and mathematical statistics.

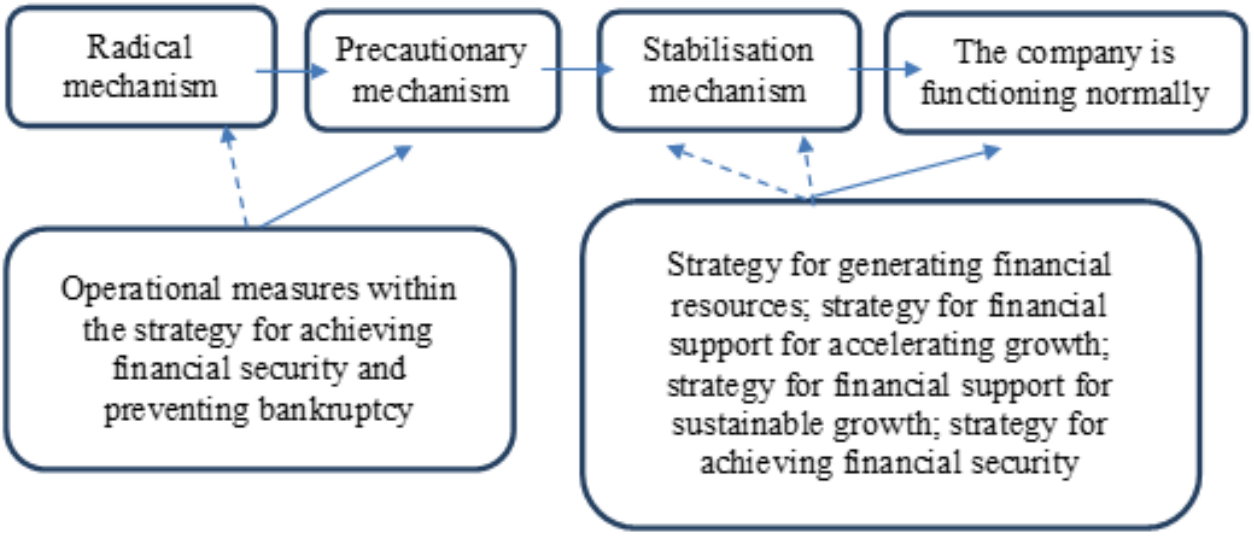
To develop a scientific and methodological approach to the selection of an organizational and economic mechanism for ensuring the financial security of gas distribution enterprises, which takes into account the combination of their status as natural monopoly entities and enterprises, the method of adaptive forecasting is used.

The information base of the study is the annual financial statements of gas distribution companies of Ukraine; scientific works of Ukrainian and foreign scientists on ensuring financial security on the issues of this study.

4. Results

Taking into account the depth of the crisis at the enterprise, it is necessary to choose a defining strategy aimed at achieving the main goal - normal functioning. The choice of the optimal type of crisis management mechanism at the researched enterprises is proposed to be carried out taking into account the mechanism of phased withdrawal of the enterprise from the crisis (Figure 1).

Figure 1.
Flowchart of the phased recovery of gas distribution companies from the crisis



Source: Own Research

If they are used effectively, the company proceeds to implement the preventive mechanism; if they are ineffective, it is necessary to review the measures or proceed to the liquidation procedure (V. B. Kropyvnytska & D. Magas (2022b).

Similarly to the previous stage, in case of effective application, the transition to a stabilization mechanism or a radical one. There are three models used in financial analysis to identify the anti-crisis potential of gas distribution companies (Table 1).

In the process of financial diagnostics of the crisis state of enterprises, it is very important to study the dynamics of key performance indicators over a certain period, most often the last 5-8 years. This is so important because it allows you to identify the time when the company began to deteriorate its performance. Hence, it is relatively easier to find the causes of the crisis, since the approximate time period is known.

The harmonic weights method is an adaptive forecasting method based on the principle of different information values of individual levels of the dynamics series for calculating the forecasted indicator. Unlike the exponential smoothing method of Bitil Shosh, Romeo Mano, and Armel Anamali, the harmonic weights method uses a moving trend rather than a moving average.

Before applying the harmonic weights method, it is necessary to check the initial series of dynamics for the absence of sharp jumps and the sufficiency of the information base for forecasting.

Table 1.
Basic models of financial analysis to identify anti-crisis potential at gas distribution companies

Model name	Structural elements	Advantages of use
Descriptive (descriptive) models	It is based on financial statements: vertical and horizontal analysis of financial statements, building a system of balance sheets, and a system of analytical ratios.	They are the most commonly used in financial analysis.
Normative models	It is based on the necessary calculated indicators against which the actual results obtained are compared, i.e. there is a system of standards that defines the desired and satisfactory state of the enterprise as the goal of activity, and the analysis of the results obtained allows to determine the degree to which the enterprise has achieved this state	They are used mainly for internal financial analysis.
Predictive models (forecasts)	Situational analysis models, dynamic analysis models, critical models	They allow you to investigate the impact of various factors on the final results, the possibility of obtaining break-even financial statements.

Source: Compiled according to scientific approaches (Aditi N. Kamath et al., 2022; Jarmila Horvathova et al., 2022; Yeletskyh S. Ya, 2014)

The first step in implementing the harmonic weights method is to form phases. A phase consists of k (usually 3 or 5) levels of the initial dynamics series. The first phase is formed by the levels y1, y2, … , yk, the second phase y2, y3, … , yk+1, and the last phase is formed by yn−k+1, yn−k+2, yn. Obviously, the number of phases formed will be equal to k = n − k + 1. For each phase, we use the least squares method to find linear regression equations (fluid trend equations):

$$y_i(t) = b_{oi} + b_{1i}t \ (i = \overline{1, K}; t = \overline{1, 1 + K - 1}). \quad (1)$$

Based on the found trends, the average values of the current trend are calculated at the points $i = \overline{1; n}$. To perform the next steps, it is necessary to test the assumption that deviations from the fluid trend are random and represent a stationary process. For this purpose, an autocorrelation error function is used. If the above assumption is met, the next step in implementing the harmonic weights method is to calculate the average increments. First, the increments are calculated using the following formula:

$$w_{t+1} = \bar{y} * (t + 1) - \overline{y(t)}. \quad (2)$$

Then we find the average growth using the formula:

$$\overline{w} = \sum_{t=1}^{n-1} C_{t+1} * w_{t+1}. \quad (3)$$

Values C_{t+1} – harmonic coefficients, which are calculated on the basis of harmonic

weights. To determine the harmonic weights, use the ratio:

$$m_{t+1} = \sum_{t=1}^{t} \frac{1}{n-i}. \quad , \tag{4}$$

$$m_{t+1} = m_i + \frac{1}{n-t}(t = \overline{1, n-1}). \tag{5}$$

The earliest information is given weight $m_2 = \frac{1}{n-1}$. The harmonic coefficients are determined by the formula:

$$C_{t+1} = \frac{m_{t+1}}{n-1}. \tag{6}$$

The point forecast is calculated as the sum of the last value of the trend series and the average growth:

$$y_{t+1}^{\text{прогноз}} = \bar{y}(t) + \bar{w}. \tag{7}$$

The confidence interval of the predicted value is found using the Chebyshev inequality for a random variable w_{t+1}:

$$P|w_{t+1} - E(w)| > a\sigma_w \quad < \frac{1}{a^2}, \tag{8}$$

where a is a given positive integer;

σ_w is the standard deviation of a random variable estimated to be:

$$\sigma_w = \sqrt{\sum_{t=1}^{n-1} C_{t+1}(w_{t+1} - \overline{w)}}. \tag{9}$$

The confidence limits for the forecast value of the indicator will be as follows:

$$y_{n+\tau}^{\text{прогн}} - A(\tau)\sigma_w \le y \le y_{n+\tau}^{\text{прогн}} + A(\tau)\sigma_w, \tag{10}$$

where τ is the forecasting horizon.

The value of $A(\tau)$ is calculated using the formula:

$$A(\tau) = a\sum_{t=1}^{t+1} C_{n-t+1}. \tag{11}$$

The application of the mathematical apparatus and the proposed algorithm for phased withdrawal of an enterprise from the crisis state makes it possible to calculate the forecast values of the integral indicator of efficiency of the crisis management mechanism, which will demonstrate the state of enterprises in the absence of active anti-crisis actions and inert functioning (Bitila Shosha et al., 2022; Omolayo Sunday Kayode et al., 2022; Maksym W. Sitnicki et al., 2022).

The results of the calculations are presented in Tables 2-5.

Table 2.

Calculation of Forecast Values of the Integral Indicator of Efficiency of the Crisis Management Mechanism at PJSC "Vinnytsiagas"

Year	Integral indicator (y)	Phases of the current trend	a_0	a_1	$\bar{y}_t$	$\overline{w_{t+1}}$	m_{t+1}	C_{t+1}^n
2013	0,499				0,458			
2014	0,445			0	0,504	0,046	0,143	0,020
2015	0,635	2012 2013 2014	-136,19	0,068	0,593	0,089	0,310	0,044
2016	0,604	2013 2014 2015	-158,79	0,079	0,620	0,026	0,510	0,073
2017	0,644	2014 2015 2016	-8,151	0,004	0,663	0,043	0,760	0,109
2018	0,767	2015 2016 2017	-162,84	0,081	0,726	0,063	1,093	0,156
2019	0,645	2016 2017 2018	-0,413	0,001	0,693	-0,033	1,593	0,228
2020	0,689	2017 2018 2019	79,004	-0,04	0,661	-0,032	2,593	0,370
2021	0,660	2018 2019 2020	-14,312	0,007	0,672	0,011	3,593	0,513
2022	0,710	2019 2020 2021	-20,673	0,011	0,697	0,025	4,593	0,656
2023	0,705	Forecast	0,71					
2024	0,728	Forecast	0,73					
2025	0,752	Forecast	0,75					

Source: Compiled from the financial statements of gas distribution companies (PJSC "VinnytsiaGas", 2023; PJSC "Chernihivgaz", 2023; PJSC "Kharkivgaz", 2023)

The results of Table 2 indicate a negative trend in the development of crisis phenomena at PJSC "Vinnytsiagas" and confirm the need for a radical mechanism of crisis management.

The results of Table 3 indicate a negative trend in the development of crisis phenomena at PJSC "Chernihivgaz" and confirm the need for a radical mechanism of crisis management.

Table 3.
Calculation of the Forecast Values of the Integral Indicator of the Efficiency of the Crisis Management Mechanism at PJSC "Chernihivgaz"

Year	Integral indicator (y)	Phases of the current trend	a_0	a_1	$\bar{y}_t$	$\overline{w_{t+1}}$	m_{t+1}	C_{t+1}^n
2013	0,293				0,304			
2014	0,356				0,328	0,024	0,143	0,02
2015	0,353	2012 2013 2014	-59,842	0,030	0,386	0,058	0,310	0,04
2016	0,552	2013 2014 2015	-197,10	0,098	0,540	0,154	0,510	0,07
2017	0,630	2014 2015 2016	-277,08	0,138	0,589	0,049	0,760	0,10
2018	0,484	2015 2016 2017	69,297	-0,034	0,553	-0,036	1,093	0,15
2019	0,753	2016 2017 2018	-123,88	0,062	0,688	0,135	1,593	0,22
2020	0,837	2017 2018 2019	-354,58	0,177	0,868	0,180	2,593	0,37
2021	0,850	2018 2019 2020	-96,317	0,048	0,862	-0,006	3,593	0,51
2022	0,880	2019 2020 2021	-42,194	0,021	0,877	0,015	4,593	0,65
2023	0,879	Forecast	0,879					
2024	0,881	Forecast	0,881					
2025	0,883	Forecast	0,883					

Source: compiled from the financial statements of gas distribution companies (PJSC "VinnytsiaGas", 2023; PJSC "Chernihivgaz", 2023; PJSC "Kharkivgaz", 2023)

The results of Table 4 indicate a negative trend in the development of crisis phenomena at PJSC "Kharkivgaz" and confirm the need to apply a stabilization mechanism of crisis management.

With a view to selecting crisis management tools that are adequate to the state of crisis phenomena at enterprises, the article proposes an interpretation of the boundaries of the integral indicator of efficiency of the crisis management mechanism.

Table 4.
Calculation of Forecast Values of the Integral Indicator of Efficiency of the Crisis Management Mechanism at PJSC "Kharkivgaz"

Year	Integral indicator (y)	Phases of the current trend	a_0	a_1	$\bar{y}_t$	$\overline{w_{t+1}}$	m_{t+1}	C_{t+1}^n
2013	0,549				0,567			
2014	0,711				0,709	0,141	0,14	0,02
2015	0,761	2012 2013 2014	-212,74	0,106	0,727	0,018	0,310	0,04
2016	0,615	2013 2014 2015	96,96	-0,048	0,680	-0,046	0,510	0,07
2017	0,811	2014 2015 2016	-49,13	0,025	0,764	0,084	0,760	0,11
2018	0,714	2015 2016 2017	-98,81	0,050	0,695	-0,069	1,093	0,16
2019	0,529	2016 2017 2018	284,63	-0,141	0,611	-0,085	1,593	0,23
2020	0,791	2017 2018 2019	-77,31	0,039	0,717	0,106	2,593	0,37
2021	0,580	2018 2019 2020	-51,17	0,026	0,659	-0,058	3,593	0,51
2022	0,570	2019 2020 2021	223,55	-0,111	0,536	-0,123	4,593	0,66
2023	0,539	Forecast	0,539					
2024	0,541	Forecast	0,541					
2025	0,543	Forecast	0,543					

Source: compiled from the financial statements of gas distribution companies (PJSC "VinnytsiaGas", 2023; PJSC "Chernihivgaz", 2023; PJSC "Kharkivgaz", 2023)

The use of an integral indicator of the effectiveness of the crisis management mechanism makes it possible to increase objectivity in assessing the probability of bankruptcy of gas distribution companies in Ukraine by taking into account non-financial indicators that directly affect the financial condition of the company (Dica Lady Silvera et al., 2022; Enni Savitri et al., 2021). The dynamics confirms the real state of enterprises and correlates with the results of the methods of assessing the probability of bankruptcy, which are most appropriate for Ukrainian enterprises (Isabel Alzate et al., 2022; Novice Patrick Bakehe et al., 2021).

5. Summary and Conclusion

If the value of the integral indicator of the effectiveness of the crisis management mechanism of gas distribution enterprises is within the range [0-0.3], it is recommended to use the following preventive tools:

— support for investment in production processes;
— motivation of shareholders;
— justification of the feasibility of investment projects;
— maintaining solvency by controlling customer payments;
— optimization of production costs;
— revision of the financial management system; formation of reserve funds to accumulate financing for the necessary increase in current and non-current assets to ensure high production growth rates;
— controlling the dynamics of short-term liabilities; increasing own funds by issuing shares or attracting investments.

If the value of the integral indicator of the effectiveness of the crisis management mechanism of gas distribution enterprises is in the range of (0.3-0.6], it is recommended to use the following stabilization tools:

— balancing the ways of attracting financial resources to minimize risks and ensure the expansion of sales volumes;
— selection of investment projects by payback period that matches the market growth rate;
— management of accounts receivable and accounts payable;
— limiting the growth of short-term liabilities compared to long-term ones;
— improving the efficiency of current production activities;
— increasing the share of equity in working capital; maintaining solvency by controlling customer payments;
— optimization of production costs;
— revision of the financial management system;
— formation of reserve accumulation funds;
— selection of flexible methods for renewing production assets;
— reduction of payments made from profits;
— optimizing the structure of assets and achieving high intensity of their use;
— diversification of suppliers;
— increasing the intensity of resource use;
— optimization of pricing policy;
— restructuring of the short-term loan portfolio with a part of them being converted to long-term loans.

If the value of the integral indicator of the effectiveness of the crisis management mechanism of gas distribution enterprises is within the range (0.6-1], it is recommended to use the following radical tools:

— saving investment resources by selecting promising business projects and conserving capital-intensive ones;

— insurance of financial risks to cover the equity capital deficit;

— achieving rhythmic cash flows;

— limiting the growth of current liabilities;

— increasing the share of quickly liquid assets;

— saving, reducing and strictly controlling operating expenses;

— maintaining the efficiency of capital use;

— reduction of payments from profits;

— taking measures to collect receivables;

— reducing the volume of financial transactions in the most risky areas of activity;

— covering losses, preventing their accumulation, selling unused assets; prolonging financial liabilities;

— liquidation of the portfolio of short-term financial investments; implementation of anti-crisis rehabilitation and restructuring).

The projected values of the integral indicator indicate the effectiveness of the mechanism at all enterprises, except for PJSC "Chernihivgaz" and PJSC "Lvivgaz", so recommendations for the latter should be based on prompt anti-crisis actions. The results of the calculations make it possible to conclude that in the absence of adequate anti-crisis measures, the functioning of enterprises will be negatively affected.

For PJSC "Kharkivgaz", the forecast values are minimal, but the results indicate the presence of crisis phenomena and the inability to overcome their consequences on their own. Thus, based on the forecasted values of the integral indicator of the effectiveness of the crisis management mechanism, it is recommended to apply a radical crisis management mechanism for PJSC "Vinnytsiagaz" and PJSC "Chernihivgaz"; and a stabilization crisis management mechanism for PJSC "Kharkivgaz".

The results of the study indicate the existence of crisis phenomena at enterprises during the analyzed period and the need to implement a crisis management mechanism, which is confirmed by the forecast values of the indicators.

The development of measures aimed at achieving efficient operation involves, at the first stage, the preparation of substantial information, analytical and methodological support, which consists in a comprehensive analysis of the activities of a gas distribution enterprise by its financial, economic, technical, technological, socio-economic indicators. Based on the results of the analysis, it is determined that at the current stage of development of gas distribution enterprises, the mechanism for ensuring the efficiency of functioning is a system of interrelated goals, objectives and measures to improve the efficiency of each subsystem of enterprise management.

Taking into account energy sector development trends caused by the spread of energy efficiency programs and harmonization of legislation with the requirements of the Third Energy Package, conducting a comprehensive analysis of financial and non-financial performance indicators and their interpretation, monitoring the dynamics of factors affecting the income and expenses of enterprises and their forecasting constitute conceptual approaches to the development of a mechanism for ensuring the efficiency of gas distribution companies. Ensuring the effectiveness of enterprise personnel management,

transformation of the gas distribution network infrastructure, and transition to incentive-based tariff setting are the main areas of the mechanism development, the coordinated implementation of which is aimed at achieving the efficiency of gas distribution enterprises. At this stage, the efficiency of gas distribution companies primarily depends on the implementation of systemic changes, including the transition to a new tariff setting model and the attraction of non-tariff investments for network development.

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