Determining the Level of Efficiency of Gas Distribution Enterprises in the Western Region of Ukraine

Dariusz SALA, Kostiantyn PAVLOV, Olena PAVLOVA, Roman DYCHKOVSKYI, Vladyslav RUSKYKH, Sergiy PYSANKO

Abstract

This article analyses the current situation and processes of structural transformations in Ukraine’s natural gas sector, particularly in its western region. The constant existence of violations of the market balance between supply and demand has necessitated reforms in the gas sector of Ukraine and its regions. From the standpoint of the unconditional importance of gas distribution companies in the structure formation and functioning of the gas sector of the state, the relevance of the proper functioning of natural gas distribution networks among consumers in times of war and political and economic crises will help reduce the level of potential risks, as well as ensure the integrity of the liberalized natural gas distribution system as a whole. The methods implemented in the process of analysing the level of efficiency of regional gas distribution systems include the methodology of expert assessments, which allowed for a generalized assessment of the expected results, contributed to the unification of existing approaches that reflect the level of economic and market efficiency, innovation activity, and financial stability of gas distribution companies. During the study, it was possible to identify the level of need for comprehensive measures, including several actions-analysis of the institutional environment of the Western Ukrainian natural gas distribution market, which includes the following joint stock companies: "Volynhaz", "Rivnehaz", "Ivano-Frankivshchaz", "Ternopilhaz", "Lvivhaz", "Zakarpathaz", "Hemlnytskhaz", "Chernivtsihaz". As a result of the study, it was possible to find out that the level of supply from Western Ukrainian gas distribution companies is regularly changing. Joint stock company "Zakarpathaz" can be considered the most promising and competitive; at the same time, Joint-stock company "Ternopilhaz" is characterized by the lowest level of its professional activity.

Keywords: gas distribution, management of gas distribution enterprises, economic and business indicators of efficiency, distribution efficiency, western Ukraine

1. Introduction

The national gas environment has been undergoing systemic structural transformation processes in the last two decades. Chronic misbalances between the supply of gas resources and the decline in aggregate demand that had been maturing for a long time and came to the surface have generated the reforming of the gas market within the regional structural units. From the viewpoint of the importance of functioning of the gas distribution network entities that are operating in total instability and political-economic crises, the institutional order will help to reduce the level of imbalance on the regional gas market, predict retrospective institutional development in the long run, foster investment, and promote integrity and accessibility of liberalized gas distribution system of the region in general.

Functional problems with regional gas distribution markets have been the subject of domestic and foreign research for a long time. Namely, such researchers as S. Hrubyak, M. Korotia, N. Linchvskva, O. Pavlova, and K. Pavlov [1–3] have contributed significantly to the development of theoretical and practical aspects of regional gas distribution markets.

Innovative issues of development at the gas distribution companies in the context of their competitiveness increase are addressed in the studies of M. Korotia, V. Kupchak, O. Novosad, O. Shandrivska, L. Horal, S. Korol, O. Dzyoba [4–6]. One way to assess competitiveness is by analyzing the market share of each gas distribution company in Western Ukraine. A higher market share generally indicates a more competitive position. [5, 7, 8]. It is necessary to note, that Ukraine has significant renewable energy potential, particularly in solar, wind, and biomass resources. The South-Eastern region is known for its favorable conditions for solar and wind energy production. [8, 9]. However, withdrawal the fossil power generating sources is impossible [10, 11]. It is necessary to use different technical and technological approaches to the management of non-renewable energy sources and do it at an economically feasible level [12, 13].

Institutional aspects of entrepreneurship development in gas distribution enterprises refer to the various structures, policies, and support mechanisms put in place by governments, organizations, and societies to foster and encourage
entrepreneurial activities. These institutional aspects play a crucial role in shaping the environment within which entrepreneurs operate and can significantly impact the success and growth of entrepreneurial ventures. [12-14].

Meanwhile, the gap in a scientific and practical combination of institutional theory with practical terms of modernization of the gas distribution companies in the Western Region of Ukraine (GDCWRU) hasn’t been eliminated yet. Ultimately, the hypothesis of stimulating the institutions of the gas distribution networks in the Western Region that generate the respective gas distribution environment should be developed, blending fragmentation and implementation of classical market theories on the systemic meso-economic level. The efficiency, reliability, and security of gas distribution will depend on that.

2. Theoretical background

Present conditions of market enhancement are characterized by the planned and intersectoral instability and they form the projected scenario of activity of the gas distribution companies in the region.

The dynamics of economic processes and their efficiency plays a crucial role in the implementation of the gas distribution companies’ development strategy and the generation of their innovative and competitive ability. In a certain manner, it creates the framework for the efficient activity of regional gas distribution companies in the Western Region and is the mandatory basis for the most efficient institutional plane of their functioning [15-16].

The methods stipulating the methodologies of expert assessments that show the grounds for subjective evaluation and expected positive results constitute the dominat-
An approach in the analysis of performance of the regional natural gas distribution markets [16, 17]. By using Monte Carlo simulation and forming theorems of data analyses, decision-makers in the natural gas industry can gain a better understanding of the uncertainties involved and make more informed and robust decisions regarding exploration, production, pricing, investment, and environmental planning [18, 19]. An important part of the natural gas management is also comparison of its processing with syn-gas.

Gasification converts solid carbon-based materials into syngas, while natural gas distribution involves transporting and delivering natural gas to end-users for various energy applications. Both processes play vital roles in the overall energy supply chain and contribute to meeting global energy needs [20, 21]. The syn gas is the transforming the solid state of coal to gaseous state. Both natural gas processing and hard coal processing are essential for ensuring the supply of usable energy sources. Natural gas processing helps remove impurities to meet safety and quality standards, while hard coal processing enhances the energy content and reduces environmental impacts associated with coal combustion [22].

Consistent competitive escalations on national and regional markets of natural gas distribution continuously increase the level of innovative activity of the gas distribution companies and digital transformation and foster the improvement of political resilience against domestic and external threats, thus securing the highest efficiency level of the institutional environment they operate in [23].

Existing methodological approaches to determining the rate of performance and innovative activity of companies and organizations offered by prominent researchers have promoted the unification of approaches that represent the objective level of economic activity, financial resilience of a company, and its innovative activity [24, 25].
3. Research objective, methodology and data

In the course of our scientific research, we have detected the need to implement the complex approach of a range of measures with further orientation on foreign and domestic approaches to the analysis of the institutional environment of the Western regional market of natural gas distribution and eight gas distribution network operators functioning on it, including [26-29]:

- AT 'Volynhaz' – 7 customer service centers (CSCs) located in Lutsk, Kovel, Kamin-Kashyrskyi, Volodymyr Volynskyi, Ratne, Kiyertsi, Horohiv;
- AT 'Rivnehaz' – 6 CSCs located in Rivne, Zdolbuniv, Sarny, Dubno, Berezn, Kostopil;
- AT 'Ivano-Frankivskhaz' – 6 CSCs located in Ivano-Frankivsk, Kalush, Kolomyia, Nadvirna, Dolyna, Snyatyn;
- AT 'Ternopilhaz' – no CSCs;
- AT 'Lvivhaz' – 5 CSCs located in Lviv, Sambir, Czervonohrad, Stryi, Pustomyty;
- AT 'Zakarpathaz' – 4 CSCs located in Uzhorod, Mukachevo, Hust, Svalyava;
- AT 'Hemlnytskhaz' – 3 CSCs located in Chernivtsi, Kitsman, Sokyrany.

It is worth considering the fact that the markets of the natural gas distribution in Ukraine and its regions are formed on market monopoly grounds controlled directly by the National Commission for State Regulation of Energy and Public Utilities (NKREKP). Its competencies sometimes fail to meet the corporate policy of avoiding the threats of sectoral functioning. Therefore, the issue should be addressed in more detail based on the researched parameters, including [30, 31]:

Relative indicators of assessment of a company's property status and efficiency of the property use. This group includes 7 main coefficients. Their main characteristics are outlined below [32]:

- fixed assets operability ratio (Rfao) is intended to detect the share of fixed assets suitable for exploitation, which directly impacts the gas distribution company's performance. It is calculated the following way:

$$ R_{fao} = \frac{\text{Residual value of fixed assets}}{\text{Original cost of fixed assets}}. $$

- fixed assets depreciation ratio (Rfad). It shows the cost of fixed assets written off as operating expenditures in previous periods. Meanwhile, the growing depreciation rate is a negative trend because the rate <0.5 is considered optimal. It is calculated the following way:

$$ R_{fad} = \frac{\text{Fixed assets depreciation}}{\text{Original cost of fixed assets}}. $$

- mobility ratio (Rmob). It indicates how quickly a company can change the structure of its assets not losing their cost. The higher is the rate the better is the situation for the company. It is calculated the following way:

$$ R_{mob} = \frac{\text{Capital and current assets}}{\text{Assets}}. $$

- capital and current assets ratio (Rcca). It characterizes the level of a company's accounting liquidity that directly impacts its performance. It is calculated the following way:

$$ R_{cca} = \frac{\text{Current assets}}{\text{Capital assets}}. $$

It is worth considering the fact that the markets of the natural gas distribution in Ukraine and its regions are formed on market monopoly grounds controlled directly by the National Commission for State Regulation of Energy and Public Utilities (NKREKP). Its competencies sometimes fail to meet the corporate policy of avoiding the threats of sectoral functioning. Therefore, the issue should be addressed in more detail based on the researched parameters, including [30, 31]:
use efficiency. To put it differently, the rate determines the volume of services granted per monetary unit (hryvnya) of financial resources invested in fixed assets. Regarding the standard value, there is no specific figure, yet, the rate should be compared to those of the competitors [33].

\[
\text{CapProd} = \frac{\text{Net sales}}{\text{Residual value of fixed assets}},
\]

(5)

- capital intensity (CapInt) is the reverse indicator to capital productivity that shows the amount of fixed assets spent per unit of output/provided services. Meanwhile, the trend towards the decrease in the coefficient value is considered positive. It is calculated the following way:

\[
\text{CapInt} = \frac{\text{Residual value of fixed assets}}{\text{Average number of regular employees}},
\]

(6)

- capital-labor ratio (Rcl). It characterizes the cost of fixed production assets per employee at the company. Basically, it is the indicator of fixed assets use efficiency that determines the level of labor equipment with fixed production assets. It is calculated the following way:

\[
\text{Rcl} = \frac{\text{Residual value of fixed assets}}{\text{Current liabilities}},
\]

(7)

Relative indicators of analysis of a company’s liquidity.

This group of indicators demonstrates the ability of a gas distribution company to quickly convert assets to money. They include the quick ratio (Rquick), current ratio (Rcurrent), and cash ratio (Rcash).

- quick ratio (Rquick). This indicator characterizes the possibility to cover the liabilities of a gas distribution company by liquid assets. The optimal coefficient value ranges within 0.7–1.

\[
\text{Rquick} = \frac{\text{Cash+Current financial investment+prepayment notes receivable+accounts receivable}}{\text{Current liabilities}},
\]

(8)

- current ratio (Rcurrent). It is the indicator of a company’s financial capacity to cover its current liabilities by current assets. Therefore, the main designation of this indicator is to demonstrate the availability of hryvnias of current assets per each monetary unit of current liabilities. The standard value of this indicator should be 1–3.

\[
\text{Rcurrent} = \frac{\text{Current assets+Capital assets for sale}}{\text{Current liabilities}},
\]

(9)

- cash ratio (Rcash). It provides an overall assessment of assets liquidity, showing what share of current liabilities a company can cover by the realization of its entire current assets, including inventories.

The coefficient within 0.1–0.2 is the standard value. A low value of the coefficient proves that a company fails to promptly repay debts if necessary. Meanwhile, high value testifies to the problems in the company and is an indicator of an inefficient strategy of financial resources management. The indicator is calculated the following way:

\[
\text{Rcash} = \frac{\text{Cash+Current financial investment}}{\text{Current liabilities}},
\]

(10)

Relative indicators of a company’s profitability.

Profitability is the main indicator of a company’s performance because it shows the level of return on assets and equity use. It is worth singling out the following profitability indicators:

- return on assets (ROA). The indicator shows the income per hryvnya of assets. There is no standard value but the higher is the rate the better a gas distribution company manages its assets:

\[
\text{ROA} = \frac{\text{Net income}}{\text{Total assets}},
\]

(11)

- return on equity (ROE). The coefficient shows how much hryvnias of profits brings one hryvnya of equity. It is calculated the following way:

\[
\text{ROE} = \frac{\text{Net income}}{\text{Equity}},
\]

(12)

- return on sales (ROS). The indicator helps to assess the efficiency of services and output realization by gas distribution companies. The higher is the rate the more successful is the company in its activity. It is calculated the following way:

\[
\text{ROS} = \frac{\text{Gross profit}}{\text{Revenues}},
\]

(13)

- return on margin (ROM). It describes the ratio of profits from sales of output/provision of services of the gas distribution companies against the incurred production costs. A higher value of the indicator is positive for a company:

\[
\text{ROM} = \frac{\text{Gross profit}}{\text{Cost of goods sold}},
\]

(14)
– equity payback period (EPP). The coefficient helps to determine the time needed to compensate the equity with profits. The lower the value the more efficient is the company:

\[
EPP = \frac{\text{Equity}}{\text{Net income}}
\]

(15)

– capital payback period (CPP). If to consider this coefficient, it characterizes the time needed to compensate all the capital of a gas distribution company (including invested capital) with the net income of the company.

\[
CPP = \frac{\text{Balance}}{\text{Net income}}
\]

(16)

Relative indicators of business activity.

It is worth mentioning that business activity is the complex characteristics of a company that determines its place on the market, describes the system of business relations, and characterizes the gas distribution company’s image and innovative-investment activity, etc. Therefore, in our opinion, the following indicators should be considered to estimate competitiveness:

– total asset turnover ratio (ATR). The coefficient shows the intensity of a company’s total capital turnover. The fact of growing current assets on condition of the company’s profit ability is a positive trend.

\[
ATR = \frac{\text{Net sales}}{\text{Total assets}}
\]

(17)

– equity turnover ratio (ETR). The coefficient indicates the intensity of a company’s equity turnover. Growing dynamics is considered positive.

\[
ETR = \frac{\text{Net sales}}{\text{Equity}}
\]

(18)

– current asset turnover ratio (CATR). It shows the number of turnovers of current assets in a certain period and the amount of net sales per one hryvnya of current assets.

\[
CATR = \frac{\text{Net sales}}{\text{Current assets}}
\]

(19)

– receivables turnover ratio (RTR). It shows how much the revenue exceeds the accounts receivable. The growing value of this indicator confirms the fact of sales with the possibility of deferred payment by the cost of agreements and deadlines as well as improving payment discipline. Therefore, the fact of dynamic growth of the indicator’s value is positive.

\[
RTR = \frac{\text{Net sales}}{\text{Accounts receivable}}
\]

(20)

– accounts payable turnover ratio (ARTR). It shows in quantitative terms how often the debt occurs over a certain period for a gas distribution company, which is subsequently covered by the latter. The growing value of this indicator (coefficient) can prove the fact of improving fulfillment of payment obligations in the process of interaction with budget organizations, creditors, and suppliers, or declining purchases with deferred payment.

\[
ARTR = \frac{\text{Product cost}}{\text{Accounts payable}}
\]

(21)

Relative indicators of financial resilience. This group of indicators demonstrates the dependence of a company’s financial risks on borrowed capital. In particular, it means that financial resilience indicators show the company’s ability to
react to the external and internal environment without decreasing the financial and production effects of the activity.

- autonomy ratio (coefficient of financial independence) \((AR)\). It reflects the share of a company's assets generated by its equity. The critical value of the coefficient is 0.5.

\[
AR = \frac{\text{Equity}}{\text{Balance}}
\]  

- financial dependence ratio (FDR). The indicator is inversely proportional to the autonomy ratio. If the indicator grows, the share of borrowed financial resources gains importance, which confirms the loss of financial independence by a gas distribution company. The value <2 is considered optimal for this indicator. If the coefficient falls to 1, it can be assumed that the company's operation is secured only due to owners' resources.

\[
FDR = \frac{\text{Balance}}{\text{Equity}}
\]  

- leverage ratio (financial risk coefficient) \((LR)\). The coefficient shows the ratio between borrowed funds and equity. It constitutes the generalized assessment of the financial resilience of a gas distribution company because it demonstrates the amount of borrowed funds against a unit of equity.

\[
LR = \frac{\text{Debt}}{\text{Equity}}
\]  

- solvency ratio (coverage coefficient) \((SR)\). When characterizing a company's solvency, it is necessary to use the solvency coefficient (coverage coefficient). It shows a gas distribution company's ability to cover debts by equity:

\[
SR = \frac{\text{Equity}}{\text{Debt}}
\]  

- self-financing ratio \((SFR)\). It indicates whether a gas distribution company has enough operating capital to secure funding of its needs in the process of current activity.

\[
SFR = \frac{\text{Operating capital}}{\text{Balance}}
\]  

- debt-to-equity ratio \((D/E)\). It shows the share of balance assets created by reliable and stable funding sources.

\[
D/E = \frac{\text{Debt}}{\text{Equity}}
\]  

Relevant indicators of regional market (region/total rate for Ukraine). In our opinion, the positions and features of a region against the national market in Ukraine should be considered to evaluate the key positions of a regional operator of gas distribution networks on the natural gas market. It eliminates the scale effect on the market and helps to adequately assess the indicators of each regional natural gas distribution market. The relevant indicators of regional market are listed below.

The specific quantity of households applying for subsidies to buy liquefied gas or solid or liquid household fuel. The specific quantity of households with assigned subsidies to buy liquefied gas or solid or liquid household fuel [34, 35].

The specific quantity of households having received subsidies to buy liquefied gas or solid or liquid household fuel. The specific weight of the sum of assigned subsidies to buy liquefied gas or solid or liquid household fuel by the type of area, total (in urban and rural areas separately). The ratio of the average size of assigned subsidies to buy liquefied gas or solid or liquid household fuel in a region and Ukraine (in urban and rural areas separately). The specific weight of the sum of received subsidies to buy liquefied gas or solid or liquid household fuel in a region (in urban and rural areas separately). The length of the gas distribution system in an oblast against the national rate (across the type of ownership). Capital investment by the types of industrial activity, gas, electricity, steam, and air conditioning supply against the total amount in an oblast, %. The growth rate of the cost and income from natural gas. The growth rate of the cost and income from liquefied gas.

Results and discussion

Based on the methodological approaches, the integral indicator of the "performance" of regional gas distribution companies under research (natural gas distribution operators) was calculated.

At the first research stage, the system of analytical indicators necessary to perform further calculations was selected and analyzed. For this purpose, a broad range of statistical and financial information regarding the activity of gas distribution companies in the Western Region of Ukraine in 2017–2021 was systematized [36–41]. For data processing, approaches were applied, which were used by authors for analyzing the economic and technical parameters in the operation of mining enterprises [42].
For example, if we analyze relative indicators of property status and efficiency of property use, the component remains to be rather negative (Table 1).

Fixed assets operability ratio (Rfao). According to Table 1, the indicator is within the optimal range (over 0.5), showing the overall satisfactory condition of fixed assets of gas distribution companies. For example, AT 'Hemlnytskhaz' had the highest coefficient in 2019 (0.621), although it decreases annually.

Fixed assets depreciation ratio (Rfad). The coefficient is in inverse proportion to the fixed assets operability ratio. The calculations show that the situation is the best for AT 'Hemlnytskhaz' (0.379).

Mobility rate (Rmob). The coefficient is rather high for AT 'Lvivhaz' against other oblast gas companies. Meanwhile, it remains low for AT 'Ivano-Frankivskhaz' (0.279).

Capital and current assets ratio (Rcca) is about the same for all oblast gas companies, yet, it is characterized by instability.

Capital productivity (CapProd). As it was already mentioned in the methodology, the best situation in terms of capital productivity among the gas distribution companies is for Lvivhaz, where the value of the indicator is 6.046, meaning that each hryvnya invested in fixed assets brings over 6 UAH of output or provided services. Meanwhile, the performance in terms of using the property of AT 'Zakarpathaz' and AT 'Ternopilhaz' is quite low: the capital productivity coefficient is 1.122 and 1.111, respectively, showing the low quality of fixed assets management (fig. 1).

Capital intensity (CapInt). Regarding the capital intensity, AT 'Lvivhaz' (0.165), AT 'Chernivtsihaz' (0.175), and AT 'Rivnehaz (0.185) can be considered the leaders by this indicator. Meanwhile, AT 'Zakarpathaz' and AT 'Ivano-Frankivskhaz' faced the problem of high production asset expenditures per unit of output/provided services: 0.891 and 0.806.

Capital-labor ratio (Rcl). Assessing the level of labor equipment with production assets, it is worth emphasizing the following facts. AT 'Volynhaz' (301.379 UAH/employee) and AT 'Hmelnytskhaz' (281.372 UAH/employee) have leading positions by this component. AT 'Ternopilhaz' is ranked the last – 144.537 UAH/employee.

The relative indicators of a company's liquidity constitute the next group of integral index indicators (Table 2).

Current ratio (Rcurrent). The optimal limits of this indicator are 0.7–1 (green color in the Table marks the optimal values and red color – negative values). As we can see, all gas distribution companies had problems with current liquidity last 2–3 years, so the possibility for a gas distribution company to cover its liabilities by promptly available liquid assets is very low.

Quick ratio (Rquick). The standard value of the indicator should be 1–3. In this case, the coefficient value is quite low and decreases annually, showing the lack of enough hryvnias of current assets per each hryvnya of current liabilities.

Cash ratio (Rcash). The coefficient within 0.1–0.2 is considered the standard value of the indicator. Unfortunately, none of the gas distribution companies adheres to the specified value, so we can assume that none of the companies under research is capable to cover debts on time in case of an urgent need. Changing of the cash ratio (Rcash) in years 2017–2021 is presented in fig. 2.

The third group of indicators includes the relative indicators of a company's profitability (Table 3). The situation for the gas distribution companies is negative because their activity...
remains lossmaking. Therefore, the return on equity and equity payback period remains to be with a negative sign. The changing of the capital payback period in years 2017–2017 is presented in fig. 3.

Relative indicators of business activity. General indicators of this group are outlined in Table 4.

The changing of the accounts payable turnover ratio (ARTR) in years 2017–2021 is presented in fig. 4.

For example, the received data shows that AT 'Chernivtsihaz' (3.121) remained in 2021 the most competitive by the total asset turnover ratio. Although the value of the coefficient declined by over 1.7 points compared to 2020. Meanwhile, Ternopilhaz or Zakarpathaz are ranked the last: the coefficient value is 0.596 and 0.351, respectively.

The equity turnover ratio for the companies under research is of negative nature due to operating losses of the gas distribution companies. The trend has been observed lately.

The current assets turnover ratio shows the maximum number of current assets turnovers in a certain period and the maximum revenues per 1 hryvnya of current assets for such gas distribution companies as AT 'Hmelnytskhaz', AT 'Rivnehaz', and AT 'Chernivtsihaz'. The coefficient values are 3.481, 3.762, and 9.035, respectively. Meanwhile, the value of the coefficient for Zakarpathaz in 2021 was very low – 0.535, and a received hryvnya of revenues didn't cover the hryvnya of current resources [43, 44].

The receivables turnover ratio was the highest in the period under research for Chernivtsihaz – 10.942 in 2021. The economic interpretation of this indicator is the following: revenues exceed the receivables 10.9 times. It indicates the facts of sales with the possibility of deferred payment by the cost of agreements and deadlines as well as improving payment discipline for the company. If we consider other gas distribution companies, for example, the value of the indicator for Zakarpathaz is much lower – 0.558, and revenues do not cover the receivables almost twice.

Analyzing the accounts payable turnover ratio, we can agree that the indicator is not stable for the gas distribution companies. For example, we can trace the negative trend for 2020–2021. It shows the deteriorating fulfillment of payment obligations in the process of interaction with budget organizations, creditors, and suppliers or declining purchases with deferred payment [45, 46].

Relative indicators of financial resilience. This group of coefficients estimates the dependence of a company’s financial risks on borrowed capital.

Therefore, the calculations indicate quite an ambiguous situation for the gas distribution companies because the companies under research are lossmaking. Meanwhile, the situation regarding the indicators under research remained almost unchanged for each gas distribution company. Changing the debt-to-equity ratio in years 2017–2021 is presented in fig. 5.

The changing the debt-to-equity ratio in years 2017–2021 is presented in fig. 6.

Changing the average number of regular employees to number of CSCs ratio in years 2017–2021 in fig. 7.

Having considered the calculated indicators of the positions of regional gas distribution system operators functioning on the Western regional natural gas market, we can see that AT 'Ternopilhaz' is in the last position. It is especially obvious by the number of households applying for subsidies to buy liquefied gas and solid and liquid household fuel, those with assigned subsidies, and those having received subsidies. Indicators of CSCs performance constitute the last group of indicators (Tables 6, 7).

The analysis of GDCWWRU performance results shows that the activity of AT 'Ternopilhaz' remains quite inefficient against the other gas distribution companies of the Western Region.

Comparing AT ‘Ternopilhaz’ (no CSC network) with AT ‘Chernivtsihaz’ and AT ‘Hmelnytskhaz’, where the network is maximally branched, consists of 11 CSCs, and is consistently expanding, we can observe one of the main problems of such result – the lack of proper service position regarding the consumer sector that lies in the absence of CSCsin the structure of AT ‘Ternopilhaz’. Thus, the population burden on the company is quite high (in the process of calculations we assumed that AT ‘Ternopilhaz’ had 1 CSC, which was the oblast gas company itself).

Therefore, the complex calculation of a broad range of indicators related to the activity of gas distribution companies operating in the Western Region of Ukraine and regional markets of distribution and consumption of natural gas as well as standardization of initially formed groups of indicators obtained in the process of the research bring about the following results (Table 8).
Conclusion

Gas distribution refers to the process of delivering natural gas or other gases from the source (such as gas fields or liquefied natural gas terminals) to end-users, including residential, commercial, and industrial customers. The purpose of gas distribution is to provide a reliable and efficient supply of gas for various purposes, including heating, cooking, hot water production, industrial processes, and power generation.

Networks for gas distribution ensure a consistent supply of gas to meet the energy needs of residential, commercial, and industrial consumers. Natural gas is a versatile and widely used energy source due to its high calorific value and relatively low environmental impact compared to other fossil fuels. Gas distribution systems are designed and operated with safety as a top priority. The purpose is to ensure the safe and reliable delivery of gas to end-users. This involves monitoring and maintaining the integrity of pipelines, implementing safety measures, conducting regular inspections, and responding quickly to gas leaks or emergencies. The purpose is to extend gas access to previously underserved regions, support economic growth, and provide an alternative to other energy sources. Expanding gas distribution networks can help promote the use of cleaner energy sources and support the transition to a more sustainable energy mix.

Gas distribution networks support economic development by enabling the use of gas for various industrial applications, power generation, and heating needs. Access to natural gas can attract businesses and industries that rely on affordable and reliable energy sources, thus driving economic growth and job creation. Overall, the purpose of gas distribution is to deliver a clean, reliable, and affordable energy

<table>
<thead>
<tr>
<th>Year</th>
<th>Regional gas distribution network operator</th>
<th>Resident population in the region to number of CSCs ratio, thousand persons/units</th>
<th>Households applying for subsidies to buy liquefied gas, solid or liquid household fuel to number of CSCs in the region ratio</th>
<th>Specific quantity of households with assigned subsidies to buy liquefied gas, solid or liquid household fuel to number of CSCs in the region 1980</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>AT ‘Volyn’</td>
<td>148.957</td>
<td>1.410.000</td>
<td>3701.714</td>
</tr>
<tr>
<td>2018</td>
<td>148.957</td>
<td>1.410.000</td>
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<td>2019</td>
<td>148.957</td>
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<td>148.957</td>
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Fig. 7. Debt-to-equity ratio in years 2017–2021

Rys. 7. Wskaźnik zadłużenia do kapitału własnego w latach 2017–2021

source to consumers while ensuring safety, reliability, and environmental sustainability. Additionally, gas distribution companies require proper management based on various economic, efficiency and clearly business indicators, as shown in this publication.

Having analyzed the data (the results of the research) in Table 7, the following conclusions can be made:

The positions of the gas distribution companies in the Western Region of Ukraine change each year, in our opinion, due to different values of their general performance indicators, low innovative activity, national natural gas distribution market condition, regional features of the gas distribution companies’ functioning, number of regional actors on the regional natural gas distribution market, regional tariffs at a certain moment in time, level of pressure of financial activity control authorities.

AT ‘Zakarpathia’ can be considered the most competitive in the last two years as it held the first position in 2020 and 2021.

The activity of Ternopilhaz remains challenging. It has severely deteriorated its positions starting since 2017. In our opinion, the causes can be the following: the lack of innovative solutions in the company’s activity, showing itself in outdated approaches to professional activity on regional natural gas distribution market, lack of initiatives offered by the company’s management to organize and further expand the Customer Service Center network in the structure of the company that would substantially facilitate the process of natural gas distribution service consumption for customers and intensify the growth of innovative activities and approaches.
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**Literatura – References**


38. Where the natural gas comes from and is supplied to consumers. URL: http://104.ua/ua/gas/id/zvidki-prirod-nij-gaz-beretsja-i-jak-dostavljajetsj-12269


Określenie poziomu efektywności przedsiębiorstw zajmujących się dystrybucją gazu w zachodnim obwodzie Ukrainy

W artykule dokonano analizy aktualnej sytuacji i procesów przemian strukturalnych w ukraińskim sektorze gazu ziemnego, szczególnie w jego zachodnim regionie. Ciągłe występowanie naruszeń równowagi rynkowej pomiędzy podażą i popytem spowodowało konieczność przeprowadzenia reform w sektorze gazowym Ukrainy i jej regionów. Z punktu widzenia bezwarunkowego znaczenia przedsiębiorstw dystrybucji gazu w kształtowaniu struktury i funkcjonowaniu sektora gazowego państwa, znaczenie prawidłowego funkcjonowania sieci dystrybucyjnych gazu ziemnego wśród odbiorców w dobie wojny oraz kryzysów polityczno-gospodarczych pozwoli na zmniejszenie poziom potencjalnych zagrożeń, a także zapewnić integralność liberalizowanego systemu dystrybucji gazu ziemnego jako całości. Metody zastosowane w procesie analizy poziomu efektywności regionalnych systemów dystrybucji gazu obejmują metodologię ocen eksperckich, co pozwoliło na uogólnioną ocenę oczekiwanych wyników, przyczyniło się do ujednolicenia istniejących podejść, odzwierciedlających poziom ekonomii i rynku efektywność, działalność innowacyjną i stabilność finansową przedsiębiorstw zajmujących się dystrybucją gazu. W trakcie badania udało się określić poziom zapotrzebowania na kompleksowe działania, obejmujące szereg działań – analizę otoczenia instytucjonalnego zachodnio ukraińskiego rynku dystrybucji gazu ziemnego, w skład którego wchodzą następujące spółki akcyjne: „Wołyńhaz”, „Również”, „Iwano-Frankiwsk”, „Ternopolhaz”, „Lvowhaz”, „Zakarpacie”, „Hemlnytschaz”, „Czerniowce”. W wyniku badania stwierdzono, że poziom dostaw z zachodnio ukraińskich spółek zajmujących się dystrybucją gazu regularnie się zmienia; Spółkę Akcyjną „Zakarpacie” można uznać za najbardziej perspektywiczną i konkurencyjną, jednocześnie Spółka Akcyjna „Ternopolhaz” charakteryzuje się najniższym poziomem swojej aktywności zawodowej.

Słowa kluczowe: dystrybucja gazu, zarządzanie przedsiębiorstwami zajmującymi się dystrybucją gazu, ekonomiczno-biznesowe wskaźniki efektywności, efektywność dystrybucji, zachodnia Ukraina