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EFFICIENCY AND INTERNATIONALIZATION OF MINING AND METALLURGICAL GROUPS OF UKRAINE

Purpose. Development of a structural and systemic approach to determining the effectiveness of the functioning and internationalization of the country's mining and metallurgical industrial groups and the formation of their possible development vectors.

Methodology. The results of the presented scientific research were obtained using general and special methods of cognition: abstract-logical analysis, systematization and combination, method of theoretical generalization, method of dialectical cognition, deduction and induction, statistical analysis, econometric method of trend formation.

Findings. Approaches to the determination of performance indicators and the level of internationalization of mining and metallurgical industrial groups, which were dynamically formed in the modern conditions of the functioning of multinational companies, were systematized. Principles of calculation, system of indicators of efficiency and level of internationalization, which were chosen to evaluate the leading mining and metallurgical industrial groups of Ukraine, and methodical approaches to the calculation of performance indicators and evaluation of the level of internationalization were substantiated, and analytical conclusions were formulated. The forecast was made and the development vectors of the country's leading mining and metallurgical industrial groups were established based on the econometric calculations.

Originality. Structural and systemic approach was justified to measuring the efficiency of operation and the level of internationalization of mining and metallurgical industrial groups of Ukraine, which is built on the principle of hierarchy, includes logically consecutive stages and provides an opportunity to determine the actual development vectors of mining and metallurgical industrial groups of Ukraine based on the econometric trend. A close relationship was established (on the basis of the calculation of the coefficient of determination) of performance indicators and the level of internationalization of mining and metallurgical industrial groups of Ukraine with the time factor. At the specification stage, trends (parabolic, logarithmic, hyperbolic, linear ones) were selected, their parameters were estimated by the method of least squares. The statistical significance of the equation was tested using the coefficient of determination and Fisher's test.

Practical value. It consists in the possibility of using the results of the conducted research for scientific developments and practical activities. The feasibility of systematic use of performance indicators and the level of internationalization in the practical activities of the leading mining and metallurgical industrial groups of Ukraine has been proven. The structural and systemic approach, which is built on the principle of hierarchy, provides an opportunity to determine the current development vectors of the leading mining and metallurgical industrial groups of Ukraine.

Keywords: *mining and metallurgical industry, internationalization, operational efficiency, operating profit, foreign assets, industrial groups*

Introduction. The functioning of the national economy in modern economic conditions is under the influence of global world processes, which in general forms a complex economic system of interrelationships of economic entities. As a result of the development of global world processes, complex economic entities are formed, whose basis involves joint, associated and subsidiary companies. Multinational companies, holdings, and transnational corporations are the foundation of the internationalization of world economies. Therefore, today's urgent issue is the study of the effectiveness of the functioning of multinational companies, taking into account the processes of internationalization. In particular, the mining and metallurgical industry of Ukraine, which is strategically important for the national economy, deserves special attention.

Literature review. As a result of the application of the a priori ranking method, M. Maksimova indicates that the most significant indicators of the company's performance assessment are the return on assets (ROA), return on equity (ROE) and invested (ROI) capital, return on sales (ROS), as well as the return on operating, ordinary and investment activity [1]. But the specified list of indicators does not allow one to quickly determine a comprehensive assessment of the company's efficiency level and make effective management decisions. To the outlined list of indicators, it is advisable to add certain types of financial results used in the foreign practice of finan-

cial analysis (EBITDA, EBIT, EBIAT, EBT, EAT, NOPAT, NOPLAT, GP, MR) and individual indicators that characterize the large business of ROTA and ROM [2]. The given indicators reflect the current state of efficiency of the companies' operational activities, but the expectations of investors are not reflected in the calculation of these indicators.

It should be noted that there is a significant number of literary sources that mention the indicators of the operational efficiency of companies in various economic aspects and representations [3, 4], they are representative works in this area. In addition to these scientific works, there are sources that characterize the financial efficiency of companies (WACC and other indicators characterizing the cost of capital) and efficiency (financial, operational) taking into account the expectations of investors (Tobin's Q, PE, market-to-book ratio) [5, 6].

An important methodological aspect of evaluating the company's performance is the use of the VBM approach, the developers of which tried to compensate for the shortcomings of the evaluation methods developed by their predecessors. According to their methodological design, the indicators that are the basis of this approach should not only reflect the growth of the company's value, but also evaluate the effectiveness of the decisions made at all levels of management, and serve as a motivation tool. The founder of the method is considered to be the scientist V. Suoyanen, who, in 1954, proposed methods of accounting for the added value of the enterprise. V. Suoyanen's proposals were implemented by large European companies only in the mid-1970s, and only in the 80s was the

EVA trademark registered by the consulting company Stern, Stewart and C. [7]. In today's conditions, the evaluation of a company's activity using value-oriented indicators is actively promoted in the service market by such well-known consulting agencies with a world name as Boston Consulting Group, LEK/Arlica's, Stern Stewart & Company, HOLT Value Associates, etc. The methods of these companies assume that future income is embodied in indicators that are derived from cash flows, profit, dividends, namely: economic added value (EVA); market added value (MVA); equity added value (SVA); monetary added value (CVA); cash flow-based return on investment (CFROI); total shareholder return (TSR) [8].

The problem of a practical study on the internationalization of the economy, which determines the relationship between financial results and the multinationality of enterprises, is the most important debatable issue today. Since the 70s of the last century, the question of the functional form of the dependence of business efficiency on the degree of international diversification has been one of the most discussed issues related to international business diversification. When using different metrics of business efficiency, the results of U-type dependence [9], inverse U-dependence [10], S-type dependence [11] were obtained. Based on the generalization of existing approaches to establishing the dependence of business efficiency on the level of internationalization of enterprises, scientists I. Blagun and P. Ilchuk systematized them and identified six groups: basic indicators; indicators determined on the basis of the range of activities; indices; indicators determined on the basis of the level of concentration of activities; indicators determined on the basis of the level of diversification of activities; indicators that take into account the participation of certain types of activities in the value chain. The most important indicators for assessing the level of internationalization are the basic indicators determined on the basis of data on product sales, assets, the number of employees, and profitability. They are, respectively, calculated as a ratio of the volume of product sales (FSTS, foreign sales as a percentage of total sales, %), assets (FATA, foreign assets as a percentage of total assets, %), the number of employees (FETE, foreign employment as a percentage of total employment, %), received profit (income) (FITI, foreign income as a percentage of total income, %) in foreign markets to the total value of the mentioned indicators [12].

Unsolved aspects of the problem. A review of literary sources shows that scientists pay considerable attention to methodological approaches to determining performance indicators and the level of internationalization of industrial companies. At the same time, approaches to evaluating the effectiveness and level of internationalization of multinational companies require further research. First of all, it concerns research in the mining and metallurgical industry, in particular such indicators as economic added value, profitability, indicators of competitive advantages of leading industrial groups that have basic assets in our country. Special attention should be paid to the processes of development vectors of the leading mining and metallurgical industrial groups of Ukraine, the methodological basis for which can be the toolkit of econometric calculations.

The purpose. Development of a structural and systemic approach to determining the effectiveness of functioning and the level of internationalization of mining and metallurgical industrial groups of Ukraine and the formation of current vectors of their development. In order to achieve the goal, it is necessary to solve the following tasks: to systematize approaches to determining efficiency indicators and the level of internationalization of mining and metallurgical industrial groups, which were dynamically formed in the modern conditions of the functioning of multinational companies; to justify the principles of calculation and the system of indicators of efficiency and the level of internationalization, which were chosen to evaluate the leading mining and metallurgical industrial groups of Ukraine; to apply methodical approaches to the calculation of performance indicators and assessment of the level of international-

ization and to formulate substantiated analytical conclusions; to carry out a forecast and establish vectors of development of the country's leading mining and metallurgical industrial groups based on econometric calculations.

Methods. The article uses a combination of general scientific and special research methods. Abstract and logical analysis, methods of systematization and combination, a method of theoretical generalization to reveal the essence of performance indicators and the level of internationalization, which were dynamically formed in the modern conditions of the functioning of multinational companies. The principles of the structural-systemic approach to the determination of efficiency indicators and the level of internationalization for the assessment of the leading mining and metallurgical industrial groups of Ukraine based on the method of dialectical cognition, deduction and induction are substantiated. Statistical analysis (coefficient analysis, relative indicators of the series of dynamics) and the method of comparison, graphic and tabular approaches provided an opportunity to analyze and systematize indicators of the effectiveness of functioning and the level of internationalization, namely: ROE, ROS, EVA, FSTS, FATA, FETE. Based on the development of econometric methods, a forecast was made and development vectors of the leading mining and metallurgical industrial groups of Ukraine were established.

Results. The basis of economic development and the basis for managing any enterprise are property resources and the efficiency of their use. For the formation of competitive advantages and effective functioning on the market of metal products, industrial enterprises of the mining and metallurgical complex need to timely form and adapt their own strategy of production and economic activity, aimed at increasing the economic effect under the influence of a system of exogenous factors, in particular the factor of internationalization. In most cases, the economic effect is associated with financial results in economic science, and profitability indicators are used to evaluate such results in relative terms. On the basis of a comprehensive review of literary sources and a generalization of scientific views, the principles of a structural-systemic approach to determining the effectiveness of functioning and the level of internationalization of mining and metallurgical industrial groups of Ukraine were formed:

- system of ROE, ROM, ROTA, ROS indicators – they are identical indicators for the net profit indicator; ROE, ROTA use information from the financial statement; ROM, ROS are calculated based on the data of the financial results report; it is expedient to leave two indicators of ROE, ROS for evaluating the performance indicators of mining and metallurgical industrial groups of Ukraine;

- EVA must be calculated based on NOPAT indicators (Net operating profit after tax, but before interest payments); WACC (weighted average cost of capital); IC (investment capital). To calculate NOPAT, it is advisable to use operating income, financial expenses, income tax expenses. It is advisable to calculate IC taking into account the value of assets, current liabilities and income of future periods; when calculating the WACC, it is necessary to take into account the cost of own and borrowed funds and the capital structure;

- the calculation of the system of internationalization indicators (FSTS, FATA, FETE, FITI) should be carried out not on the basis of the base of the registered parent company (Great Britain, Cyprus, Luxembourg), but on the basis of the basic assets of Ukraine, sales of products in the home country (Ukraine); the number of employees based in Ukraine (Ukraine).

The proposed structural-systemic approach to measuring the efficiency of functioning and the level of internationalization of mining and metallurgical industrial groups of Ukraine, which is built on the principle of hierarchy, includes the following logically consecutive stages: analytical substantiation of the system of indicators for assessing the financial condition and financial results of leading mining and metallurgical in-

dustrial groups of Ukraine; calculation of economic efficiency and level of internationalization of the leading mining and metallurgical industrial groups of Ukraine; determination of current vectors of development of the leading mining and metallurgical industrial groups of Ukraine based on the construction of an econometric trend.

Analytical substantiation of the system of indicators for assessing the financial condition and financial results of the leading mining and metallurgical industrial groups of Ukraine. All leading mining and metallurgical industrial groups of the country have positively growing property assets in the period 2015–2021. The total value of assets of industrial groups increased by 22.9 billion dollars, in percentage terms – by 26 % (Table 1). Dynamic trends of increase are observed in equity and income from sales: the total value of the first indicator increased by 30.27 billion dollars (93.3 %); the second – by 16.7 billion dollars (23 %).

Steadily growing net and operating profit was generated during the analyzed period by the multinational companies Ferrexpo and Metinvestholding, in addition, reserves are being monitored to increase. The mining and metallurgical company Interpipe was unprofitable in the period 2016–2018; the financial management enabled the company to reach the mark of 91 million dollars of profit (2021). The mining and metallurgical company ArcelorMittal had dynamic loss gaps in

2015, 2019 and 2020, but in 2021, the multinational enterprise received a dynamic maximum of 15.5 billion dollars [16].

In the first weeks of the war, all Ukrainian metallurgical plants producing flat rolled products and semi-finished products (PJSC “MC “Azovstal”, PJSC “MMC named after Ilyich”, PJSC “MC “Zaporizhstal”) were stopped; besides this, PJSC “Arcelor Mittal Kryvyi Rih”, the manufacturer of rolled products did not work and this was an “economic shock” for the EU countries, because Ukraine provided 34 % of the demand for steel sheet in the EU in 2021 and about 50 % of the square steel billet. During the following months of the war, the international mining and metallurgical group of companies “Metinvestholding” in 2022 unfortunately lost strategic assets (PJSC “MC “Azovstal”, PJSC “MMC named after Ilyich”), that is, respectively, almost 2,448 and 3,100 million dollars of the value of assets and 14.4 and 6.4 million dollars of net profit.

The mining department of PJSC “Arcelor Mittal Kryvyi Rih” continues to produce iron ore with a reduced load on production facilities. In April 2022, the company plans to increase production of iron ore concentrate to 500,000 tons compared to 320,000 tons of raw materials shipped in March of this year. The Ferrexpo company has reduced the loading of production facilities, but continues to support the export of pellets to the EU by rail. PJSC “Central HZK” in Kryvyi Rih, as well as other HZKs in this region, also operate in the mode

Table 1

Absolute indicators of the assessment of the financial condition and financial results of the leading mining and metallurgical industrial groups of Ukraine

Indicators, million dollars	2015	2016	2017	2018	2019	2020	2021
Metinvestholding							
Assets	9182	9331	10083	11178	13837	13454	17047
Equity	4024	4028	4308	5403	6930	6055	9133
Loan capital	5158	5303	5775	5775	6907	6958	7914
Income from sales	6832	6223	8931	11880	10757	10453	8470
Net profit	-1003	118	617	1188	341	526	2769
Operating profit	-686	325	1300	1556	325	847	2760
Interpipe							
Assets	666	579	603	977	1268	928	1170
Equity	628	787	857	670	449	520	435
Loan capital	1294	1365	1459	1646	819	407	736
Income from sales	626	507	806	1074	1122	865	1132
Net profit	-76	-173	-67	-48	829	195	91
Operating profit	9	-61	40	55	83	213	147
ArcelorMittal							
Assets	76,846	75,142	85,297	91,249	87,908	82,052	90,512
Equity	27,570	32,325	40,855	44,108	40,483	40,237	51,344
Loan capital	49,276	42,817	44,442	47,141	47,425	41,815	39,168
Income from sales	63,578	56,791	68,679	76,033	70,615	5327	76,571
Net profit	-8423	1734	4575	5330	-2391	-578	15,565
Operating profit	-4	4	5434	6539	-627	2110	16,976
Ferrexpo							
Assets	1225	1163	1222	1392	1940	1955	2092
Equity	244	324	596	867	1353	1491	1831
Loan capital	982	840	625	525	587	463	260
Income from sales	961	986	1197	1274	1507	1700	2518
Net profit	31	189	394	335	403	635	871
Operating profit	251	314	490	428	497	754	1082

of partial loading of production capacities (35–40 %). In particular, PrJSC “Inhuletskyi HZK” shipped 10,000 tons of iron ore concentrate to consumers in Europe in March 2022. JSC “Southern HZK” produced 411,000 tons of iron ore concentrate in March 2022, despite the military situation in Ukraine. PJSC “KAMET-STEEL” is the only enterprise in Ukraine that in March 2022 was operating at almost full capacity.

The metallurgical capacity of PJSC “Interpipe Steel” have been shut down and is being conserved. PJSC “Avdiiv Coke Plant” does not work, being in hot preservation, as it is located in the immediate zone of hostilities. The key divisions of PrJSC “Zaporizhzhok” were taken out of conservation, the company partially resumed the work of the coal preparation and coke workshops, capture and desulfurization workshops, as well as auxiliary divisions. Also, three coke batteries are brought out of conservation to planned production parameters. PJSC Shakhtoupravlinnia Pokrovske, as the largest producer of coking coal in Ukraine, continues its work [13].

In just one month of military operations, economic entities, not working, suffer losses in the amount of UAH 2.1 billion, and this is exclusively for one branch of the national economy. The outlined losses are catastrophic for the financial results of the industry, the profitability of which during the last 10 years does not rise above 7 %.

Economic efficiency and level of internationalization of leading mining and metallurgical industrial groups of Ukraine. The period of 2019–2021 was the most effective in terms of the economic activity of the leading mining and metallurgical industrial groups of Ukraine (Table 2). The ROS indicator of Metinvestholding has increased more than 2 times, positive trends can be seen in the dynamics of the economic added value (EVA); in 2021 this indicator has the maximum level for the last 7 years. Mining and metallurgical company Interpipe has a parabolic trend of ROS, ROE with its minimum in 2016 – –21.9 %; –34.1 %, respectively, and the maximum in 2019 – +184.5 %; +73.9 % respectively; the largest economic added value was generated by the industrial group in 2020 – 102.4 million dollars.

Table 2

Dynamics of economic efficiency indicators of leading mining and metallurgical industrial groups of Ukraine

Years	NOPAT, million dollars	IC, million dollars	WACC, million dollars	EVA, million dollars	ROE, %	ROS, %
Metinvestholding						
2015	–1482.0	4810.0	9.5	–1937.2	–24.9	–14.7
2016	–113.0	4814.0	9.8	–585.3	2.9	1.9
2017	726.0	7796.0	8.0	105.6	14.3	6.9
2018	947.0	8444.0	9.0	188.3	22.0	10.0
2019	2.0	10437.0	4.4	–455.5	4.9	3.2
2020	181.0	9888.0	5.8	–390.0	8.7	5.0
2021	2113.0	12,626.0	4.9	1491.2	30.3	20.4
Interpipe						
2015	–107.2	–559.0	32.3	73.5	–12.1	–12.2
2016	–1025.8	–716.4	39.0	–746.1	–21.9	–34.1
2017	–76.4	–781.2	33.0	181.6	–7.8	–8.3
2018	–108.9	–563.2	27.8	47.6	–7.1	–4.5
2019	–61.4	844.3	7.4	–123.7	184.5	73.9
2020	141.8	755.2	5.2	102.4	37.5	22.6
2021	82.6	938.6	6.0	26.6	20.99	8.1
ArcelorMittal						
2015	–909.02	58,805.00	10.70	–7203.03	–30.55	–13.25
2016	–3037.84	57,027.00	9.83	–8641.35	5.36	3.05
2017	4127.00	63,887.00	7.38	–590.03	11.20	6.66
2018	3980.00	67,794.00	8.98	–2110.84	12.08	7.01
2019	–2738.00	66,621.00	5.21	–6205.94	–5.91	–3.39
2020	–812.00	59,385.00	5.78	–4241.49	–1.44	–10.85
2021	13,361.00	66,345.00	4.73	10,225.37	30.32	20.33
Ferrexpo						
2015	173.17	962.10	13.20	46.17	12.71	3.23
2016	204.41	846.08	11.41	107.86	58.31	19.17
2017	379.94	805.73	7.28	321.28	66.10	32.92
2018	331.45	1087.89	7.02	255.12	38.64	26.30
2019	417.67	1663.43	0.37	411.46	29.79	26.74
2020	629.44	1659.02	3.65	568.90	42.58	37.35
2021	873.56	1863.71	2.78	821.67	47.56	34.59

The ArcelorMittal industrial group, in connection with the negative NOPAT indicator, received meager relative indicators of ROS and ROE in 2015 – –30.55 %; –13.25 %, respectively, and in 2020 – –1.44 %; –10.85 %, respectively. During 2015–2021, the industrial group generated economic added value only in 2021 – 10,225.37 million dollars [16]. The Ferrexpo industrial group has the most significant level of efficiency (Table 2). The economic added value of the industrial group for the period 2015–2021 increased almost eighteen times, the relative ROE indicator increased by 34.82 %; ROS – by 31.36 % [17].

The leading mining and metallurgical industrial groups of Ukraine have a high level of the FSTS indicator – 70–99 %, which confirms the high competitiveness on the international markets of metal products (Table 3).

Table 3

Dynamics of indicators of internationalization of the leading mining and metallurgical industrial groups of Ukraine

Years	FSTS, foreign sales as the percentage of total sales, %	FETE, foreign employment as the percentage of total employment, %	FATA, foreign assets as the percentage of total assets, %
Metinvestholding			
2015	76.3	2.3	6.0
2016	74.2	2.4	8.0
2017	72.4	3.2	8.0
2018	71.9	3.2	8.0
2019	70.7	3.2	5.0
2020	71.9	3.1	5.0
2021	74.2	3.1	5.0
Interpipe			
2015	76.9	4.0	18.3
2016	72.4	3.1	12.3
2017	70.4	3.2	0.1
2018	70.3	3.1	0.1
2019	71.1	3.3	0.2
2020	73.9	3.1	0.2
2021	73.5	3.1	0.0
ArcelorMittal			
2015	99.2	86.3	95.5
2016	99.2	87.4	96.0
2017	99.2	88.2	96.5
2018	99.2	90.1	96.2
2019	99.2	89.5	95.5
2020	90.3	88.4	96.0
2021	98.8	87.6	95.9
Ferrexpo			
2015	93.2	5.6	1.0
2016	93.5	6.0	1.0
2017	94.0	6.0	1.0
2018	95.8	6.3	1.0
2019	96.0	5.2	0.8
2020	97.0	4.6	0.8
2021	97.7	4.6	0.8

According to the results of 2021, Ukraine supplied a total of more than 3.4 million tons of pig iron, which is about 30 % of the world export of pig iron. Exports practically stopped in the first month of the war, that is, buyer countries – the USA, Italy, Turkey and others – could not use imported iron for further remelting into steel. Thus, as a result of the first month of hostilities, a raw material crisis of a global scale arose, which led to a significant increase in the price of steel, pig iron, and steel semi-finished products.

Foreign assets of industrial groups deserve special attention in the conducted research. This indicator is not a priority for them and decreases every year for all mining and metallurgical multinational companies of the country. At most enterprises of Metinvestholding, Interpipe, Ferrexpo, a significant part of non-current assets is concentrated in Ukraine based (Ukraine), which is confirmed by the value of the FATA indicator – 0.01–6 % [14, 15].

Such domestic concentration of assets binds production and economic personnel to itself. Thus, the FATA indicator of industrial groups Metinvestholding, Interpipe, Ferrexpo is 2.3–6.3 %. In most cases, foreign-based personnel are sales representatives, logisticians, marketers, and administrative personnel of the management structure.

ArcelorMittal has a very high level of internationalization due to the large scale of its activities, significant branching of sales markets, foreign assets. From more than 75 billion dollars 90–99 % of the sales volume goes to foreign markets; the volume of assets in the countries of Asia, North and South America is UAH 53 billion, and the total number of personnel exceeds 158 thousand people [16].

Vectors of development of the leading mining and metallurgical industrial groups of Ukraine. Using the econometric trend method, forecast indicators of efficiency and the level of internationalization of the leading mining and metallurgical industrial groups of Ukraine were calculated (Table 4) and the dependence of each of the indicators on the time level was established.

At the specification stage, parabolic, logarithmic, hyperbolic, and linear trends were selected and their parameters were estimated by the method of least squares. The statistical significance of the equation was tested using the coefficient of determination and Fisher's test. It was established that in the studied situation, in statistically significant equations, 60–95 % of the total variability of the indicators is explained by the change in the time parameter.

According to the forecast model, the Metinvestholding industrial group will increase its FSTS, FETE internationalization indicators and strengthen its global positions. Based on the forecast performance indicators, further unprofitability of the activity is possible with a sufficiently significant economic added value.

The results of the calculation of Interpipe's predictive indicators showed only two significant equations according to the indicators of FSTS, FATA. In the future, based on the built forecast model, the multinational industrial group will turn into a large national manufacturer without foreign assets, which will confidently increase export volumes of metal products. The Ferrexpo industrial group, according to the implemented forecast, will work exclusively for export and will gradually reduce the volume of foreign assets and international employees, financial indicators are projected at a consistently high level, namely 42–50 %.

Conclusions. Thus, the result of the conducted research is the development of a structural and systemic approach to measuring the effectiveness of functioning and the level of internationalization of mining and metallurgical industrial groups of Ukraine and the formation of actual vectors of their development.

Using abstract and logical analysis, methods of systematization and combination, the method of theoretical generalization, a system of indicators was formed for evaluating the efficiency and level of internationalization of the country's lead-

Table 4

Calculation of parameters of the trend level of efficiency and internationalization indicators of leading mining and metallurgical industrial groups of Ukraine

Indicators	FSTS, %	FETE, %	FATA, %	EVA, million dollars	ROE, %	ROS, %
Metinvestholding						
Determination index	0.95	0.71	0.60	0.6	0.6	0.6
F–statistics (Fischer’s criterion)	$F > F_{kp}$	$F > F_{kp}$	$F < F_{kp}$	$F > F_{kp}$	$F > F_{kp}$	$F > F_{kp}$
Point forecasts						
2022	76.37	6.27	2.43	7894.0	15.3	20.1
2023	79.74	6.76	0.29	9091.0	8.6	23.9
2024	83.95	7.25	–2.24	10,288.0	–0.9	27.8
type of trend	parabolic	logarithmic	parabolic	logarithmic	linear	linear
trend equation	$0.424t^2 - 384t + 79.97$	$0.492\ln(t) + 2.329$	$-0.19t^2 + 1.095t + 5.857$	$1197.29\ln(t) - 1684.285$	$-1.412t^2 + 17.288t - 32.6$	$3.85t - 10.729$
Interpipe						
Determination index	0.81	0.61	0.90	0.38	0.38	0.17
F–statistics (Fischer’s criterion)	$F > F_{kp}$	$F < F_{kp}$	$F > F_{kp}$	$F < F_{kp}$	$F < F_{kp}$	$F < F_{kp}$
Point forecasts						
2022	78.3	3.4	–1.3	195.5	24.7	10.3
2023	83.1	3.7	–1.7	525.8	30.2	12.5
2024	88.9	5.0	–1.9	1414.0	35.6	14.7
type of trend	parabolic	parabolic	hyperbolic	exponential	linear	linear
trend equation	$0.551t^2 - 4.642t + 80.18$	$0.0429t^2 - 0.436t + 4.157$	$23.66/t - 4.293$	$0.0715e^{0.989t}$	$5.429t - 18.7$	$2.229t - 7.543$
ArcelorMittal						
Determination index	0.19	0.88	0.04	0.35	0.40	0.18
F–statistics (Fischer’s criterion)	$F < F_{kp}$	$F > F_{kp}$	$F < F_{kp}$	$F < F_{kp}$	$F < F_{kp}$	$F < F_{kp}$
Point forecasts						
2022	94.9	85.8	96.7	34923.00	24.70	10.35
2023	94.0	83.5	96.8	40468.00	30.13	12.60
2024	93.0	80.6	96.9	46013.00	35.50	14.84
type of trend	parabolic	parabolic	logarithmic	logarithmic	linear	linear
trend equation	$-0.0238t^2 - 0.488t + 100.3$	$-0.286t^2 + 2.543t + 83.76$	$0.112\ln(t) + 95.807$	$5544.719\ln(t) - 9433.848$	$5.425t - 18.691$	$2.246t - 7.619$
Ferrexpo						
Determination index	0.97	0.50	0.75	0.78	0.02	0.67
F–statistics (Fischer’s criterion)	$F > F_{kp}$	$F < F_{kp}$	$F > F_{kp}$	$F > F_{kp}$	$F < F_{kp}$	$F > F_{kp}$
Point forecasts						
2022	98.5	4.5	0.74	2718.00	47.50	42.64
2023	99.3	4.3	0.70	3065.00	48.10	44.57
2024	100.0	4.0	0.66	3412.00	50.12	46.50
type of trend	linear	linear	linear	logarithmic	linear	linear
trend equation	$0.804t + 92.1$	$-0.236t + 6.414$	$-0.0429t + 1.086$	$347.428\ln(t) - 61.346$	$1.314t + 36.987$	$1.929t + 27.206$

ing multinational metallurgical groups: FSTS, FETE, FATA, EVA, ROE, ROS, and their basic calculation principles were substantiated.

On the basis of the use of methodical approaches to the calculation of performance indicators and internationalization, the following trends in the development of mining and metallurgical industrial groups of Ukraine have been established:

- in connection with the scale of activity, significant branching of sales markets, foreign assets, ArcelorMittal has the highest level of internationalization, but there are signifi-

cant problems with business efficiency: the minimum relative indicators of ROS and ROE in 2015 – –30.55 %; –13.25 %, respectively, and in 2020 – –1.44 %; –10.85 %, respectively. This indicates an increase in the cost component (based on the scale effect) and the unprofitability of subsidiary companies;

- the significant concentration of assets in the home country and the attachment of production and economic personnel to it enables industrial groups Metinvestholding, Interpipe, Ferrexpo to increase economic added value and gradually increase efficiency indicators, which corresponds to the effectiveness of the “strategy of asset concentration”.

Based on the application of the econometric trend method, the current development vectors of the mining and metallurgical industrial groups of Ukraine were determined and the following forecast trends were substantiated:

- the Metinvestholding industrial group will strengthen its global world positions, but in the long term, unprofitable lags are possible, which may affect the total value of assets;
- multinational industrial group Interpipe will turn into a large national manufacturer with no foreign assets, which will gradually increase export volumes of metal products;
- the Ferrexpo industrial group will work exclusively on foreign sales markets (exports) and will reduce the volume of foreign assets and international employees; effective financial indicators will be at a consistently high level (42–50 %).

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Ефективність та інтернаціоналізація гірничо-металургійних груп України

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Мета. Розробка структурно- системного підходу до визначення ефективності функціонування та інтернаціоналізації гірничо-металургійних промислових груп країни, формування їх можливих векторів розвитку.

Методика. Результати представленого наукового дослідження отримані за використання загальних і спеціальних методів пізнання: абстрактно-логічний аналіз; систематизація й комбінування; метод теоретичного узагальнення; метод діалектичного пізнання; дедукція та індукція; статистичний аналіз; економетричний метод формування тренду.

Результати. Систематизовані підходи до визначення показників ефективності й рівня інтернаціоналізації гірничо-металургійних промислових груп, що динамічно сформувалися в сучасних умовах функціонування мультинаціональних компаній. Обґрунтовані принципи розрахунку, систему показників ефективності й рівня інтернаціоналізації, що обрані для оцінки провідних гірничо-металургійних промислових груп України, і методичні підходи до розрахунку показників ефективності функціонування та оцінки рівня інтернаціоналізації, сформульовані аналітичні висновки. Здійснено прогноз і встановлені вектори розвитку провідних гірничо-металургійних промислових груп країни на підставі опрацювання економетричних розрахунків.

Наукова новизна. Обґрунтовано структурно-системний підхід до вимірювання ефективності функціонування й рівня інтернаціоналізації гірничо-металургійних промислових груп України, що побудований на принципі ієрархічності, включає логічно послідовні етапи та надає можливість на основі економетричного тренду визначити актуальні вектори розвитку гірничо-металургійних промислових груп України. Встановлено щільний зв'язок (на підставі розрахунку коефіцієнта детермінації) показників ефективності функціонування й рівня інтернаціоналізації гірничо-металургійних промислових груп України із часовим фактором. На етапі специфікації обрані тренди (параболічний, логарифмічний, гіперболічний, лінійний), оцінені їх параметри методом найменших квадратів. Статистична значущість рівняння перевірена за допомогою коефіцієнта детермінації та критерія Фішера.

Практична значимість. Полягає в можливості використання результатів проведеного дослідження для наукових розробок і у практичній діяльності. Доведена доцільність систематичного використання показників ефективності функціонування та рівня інтернаціоналізації у практичній діяльності провідних гірничо-металургійних промислових груп України. Структурно-системний підхід, що побудовано на принципі ієрархічності, надає можливість визначити актуальні вектори розвитку провідних гірничо-металургійних промислових груп України.

Ключові слова: гірничо-металургійна промисловість, інтернаціоналізація, операційний прибуток, закордонні активи, промислові групи

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