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Development of Domestic Chemical Industry in the Conditions of Globalization

Abstract. The article is devoted to the analysis of characteristic features, problems and prospects of development of the chemical industry of Ukraine in the conditions of action of global factors. The peculiarities of the functioning of the world market of the chemical industry are given. Based on the annual global rating "Global 500" and using the application package On Front, DEA-analysis was used to assess the effectiveness of the world's leading chemical companies. Input variables — indicators of assets of companies and the number of their employees, and the output variable — an indicator of income, which allowed to determine the most optimal use of these enterprises resources that they direct to production activities. Attention is paid to find out of modern features and issues related to export activity of the domestic industry, which is formed under the influence of both internal transformations and global factors. The analysis of the industry development is conducted, a number of threats and challenges for its development are revealed. On the basis of the conducted research the perspective directions of further development of the domestic

chemical branch are substantiated, which include the processes of import substitution, attraction of highly efficient investments, intensification of innovative activity, modernization of equipment, optimization of export and import structure.

Keywords: chemical industry, exports, efficiency of activity, global economy, competitiveness of products

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1. Formulation of the Problem

Foreign economic relations of the world are determined by the processes of transnationalization and globalization, accordinly there are structural changes in international trade, changes in the factors of achieving competitiveness of goods in world markets. On such conditions, the country's economy and its main export industries may face risks of weakening competitive positions and destabilizing the position of individual product groups in traditional export markets, the need to increase product competitiveness primarily through the introduction of new decisions.

The economy of Ukraine remains export-oriented, at the same time its involvement in the world market has a more characteristic resource character, as the dominant component of exports is products with a low degree of processing. The modern structure of domestic exports tends to deteriorate due to a decrease the part of the products of the metallurgical complex, chemical industry, high-tech products and an increase the part of the products with low added value. Therefore, the further development of foreign trade requires the development of new approaches in light of deepening economic integration of Ukraine and as a result of the development of the knowledge-based economy, which determine the priorities and directions for achieving high efficiency in foreign trade by producing and salling high value added products on world markets.

2. Aims and Methodology of the Study

The aim of the article is research the modern state and exposure of prospects for the transformation of the commodity structure of Ukrainian exports and is to study the features, problems and prospects of the domestic chemical industry in the context of changes that take place at global level.

3. Main Results of the Study

In the structure of domestic export deliveries during 2001–2020, the share of base metals and articles of base metal decreased from 41,3% to 18,4%; vehicles — from 3,4% to 1,5%; chemical industry products — from 9 to 4,1%; machines, equipment and mechanisms — from 10,5 to 9,1%. However, the share of plant products increased from 4,26 to 24,2%; animal or vegetable fats and oils — from 1,39% to 11,7%. The problem is not only the dominance of raw material exports, but the low export of industrial and high-tech goods.

Most industries are developing under the influence of not only domestic but also global factors. Their competitiveness and strengthening of export capacities directly determine the country's foreign exchange earnings, the state of the balance of payments and the possibilities of technological updating directly. The global dimension of the development of export industries causes a number of threats and challenges that should be kept in mind when developing strategic priorities of industries.

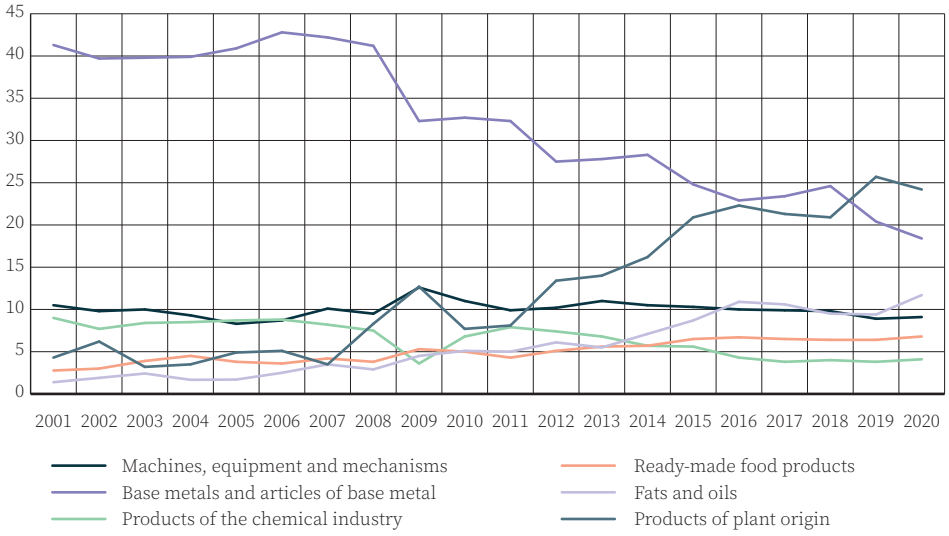

Figure 1. Structure of Ukraine's exports by individual product groups, 2001–2020.
Source: Based on Ukrainian statistical data for 2020

Domestic scientists note that the chemical industry of Ukraine is directly affected by the consequences of the transformation of the competitive environment in the global chemical market, among the key trends in the global chemical industry in recent years they highlight the following: mergers and acquisitions, new

regulatory environment, intensification of investment activities, introduction of innovative technologies (Ishchuk & Koval, 2019, p. 214).

Analysis of the dynamics of Ukraine's foreign trade in chemical products allows us to state that the foreign trade balance in the period 2000–2020 was positive only in 2000 and amounted to $382,2 million. The positive dynamics of exports, which was interrupted by the global financial crisis in 2008, showed a short-term recovery in 2011–2012, but in 2016, exports fell sharply in 2016 to $1277,7 million. As of 2020, there was a slight increase in exports to $1728 million.

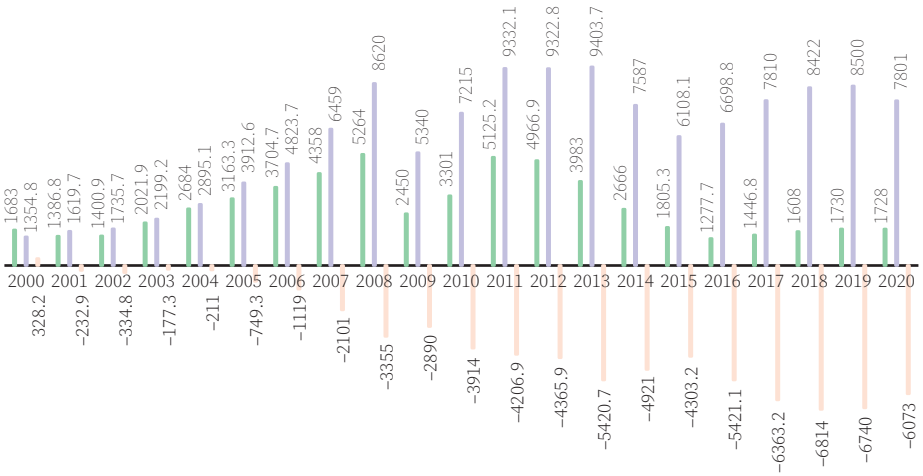

Figure 2. Foreign trade in chemical and petrochemical products in Ukraine in 2000–2020, million US dollars.
Source: SSSU (2020)

In terms of annual gross turnover in the chemical industry, Ukraine in 2020 will reach an enough low level (4.6 billion US dollars), which is close to Bulgaria, Romania, Indonesia, Vietnam (2–5 billion US dollars). In the substantial majority of industrially developed countries, the annual turnover of the chemical industry exceeds 8–10 billion US dollars, the average is in the range of 50 to 100 billion US dollars. All this indicates that the competitiveness of domestic chemical production is gradually declining. In the substantial majority of industrialized countries, the average range of the share of the chemical industry in industrial production is from 8–9 to 18–20%. The minimum level of this indicator in the substantial majority of countries is not less than 5% (ChDNDITEIVKhP, 2020).

Analyzing the annual rating of global companies "Global 500", which is based on the methodology of Fortune magazine (the criterion is the company's profitability) for 2020, we note that the 500 largest companies in the world include 8 companies belonging to the chemical industry. Among them, two each repre-

sent China and the United States, one each from Germany, the Netherlands, Japan and the United Kingdom.

It is advisable to investigate how effective the world's largest chemical companies are in terms of the ratio of resources used and the results obtained. We used the method of DEA-analysis, which allowed each company to calculate the efficiency ratio of their activities.

DEA-analysis is based on the use of the basic postulate of a market economy — the production capacity curve, which reflects the maximum efficiency of production resources, which is determined by the maximum possible output of goods and services for available technologies and available resources. Hence, the algorithm for determining efficiency is to construct a corresponding curve of production capacity and the location of the research objects relative to it.

Efficiency can be estimated after producing of products by construction of output-oriented model, and using resources — input-oriented model. In this case, efficiency means the ratio of the set of values of input parameters to the set of values of output parameters, the value of the efficiency varies from 0 to 1. Accordingly, the object with a value close to 1, rationally uses resources, works at full capacity and is efficient. This technology can be used to analyze industries of economy, regions, large companies and enterprises of different sizes.

In our research, as input variables, we used indicators of company assets and the number of their employees, the output variable was the income indicator. The data used by us for calculations are given in table 1.

Table 1. Indicators of chemical companies included in the "Global 500" rating in 2020.

Place in the rating	Name	Income, million USD	Assets, million USD	Number of employees
143	BASF	70,723	97,593	117,628
164	ChemChina	65,767	121,160	145,526
283	Dow	42,951	60,524	36,500
360	LyondellBasell Industries	34,727	30,435	19,100
376	Mitsubishi Chemical Holdings	33,418	47,489	69,609
389	3M	32,136	44,659	96,163
444	Linde	28,677	86,612	79,886
455	Shenghong Holding Group	27,870	13,562	30,631

Source: Based on Fortune (2020)

Software implementation of DEA-analysis was carried out using the application package On Front. As a result of building an input-oriented model, we calculated the efficiency coefficients, the values of which are presented in fig. 3.

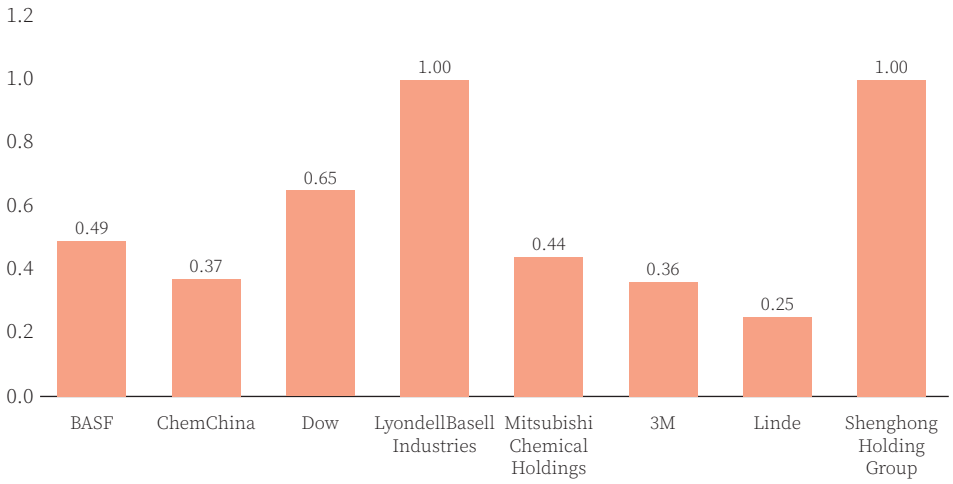

Figure 3. Coefficients of efficiency of the leading companies of the chemical industry
Source: Authors' calculations

As we can see, among the companies we have considered, LyondellBasell Industries (Netherlands) and Shenghong Holding Group (China) are effective, for which the value of the efficiency ratio is equal to one. This indicates the optimal use of these enterprises resources that they direct to production activities. All other companies should optimize the use of their resources, because they can get a similar income by reducing inputs.

It can be noted that in 2020, the 500 largest companies in the world received $33,3 trillion of income. At the same time, the total income received by chemical companies is $336,269 million, that is 1%.

The domestic chemical industry has experienced a partial shutdown of production at some enterprises and a physical loss of powers as a result of destruction from military operations on the east of the country. The industry experiences disparities in the production of goods by different sectors of the industry, as well as a low level of manufacturability and energy intensity of the industry and high — import dependence, which negatively affects the competitiveness of products. There is an increase in the share of energy-intensive and raw materials industries, a decrease in the share of knowledge-intensive products sold and products of deep processing of the industry. There is a significant negative balance of foreign trade and a gradual decline in the share of the chemical industry in total exports (from 9% in 2001 to 4,1% in 2020).

There is a narrowing of the range of exported products, dominance in the structure of exports of semi-finished products and raw materials. Thus, in 2020,

inorganic chemical products worth $741,8 million (1,5% of total exports), organic chemical compounds — $174,1 million (0,4%), pharmaceuticals — $268,2 million (0,5%), fertilizers — $277,4 million (0.8%), tannin extracts — $114, 2 million (0,2%), essential oils — $95, 7 million (0,2%), organic surfactants — $41,7 million (0,1%), protein substances — $52,6 million (0,1%). Domestic scientists emphasize that the current structure of exports increases economic dependence on external factors, in particular, with rising energy prices, Ukrainian chemical producers become uncompetitive not only in foreign markets, but also lose their price competitiveness in the domestic market (Deineko, 2018, p. 46).

Exports are carried out to the markets of the CIS countries, the EU, the Middle East, where competition is constantly intensifying. The largest suppliers to the domestic market are the countries of Europe, the CIS and Asia (for chemical companies in the CIS, natural gas as a raw material is significantly cheaper than for domestic).

Threats should be seen in the increase of price of natural gas, that is key raw materials for the chemical industry; dependence on imports of raw materials used in the production of domestic products (sulfur, phosphorites, potassium chloride, etc.); changes in demand for chemical products on world markets, fluctuations in world prices for chemical products. At world level displacement of global balance take place towards suggestion — the introduction of new production capacities in the world, in particular during the last two decades in Europe, the United States and Asia have put into operation almost 200 modern nitrogen industrial sites (Falko, 2019). Exacerbation of competition in world markets for chemical products necessitates the creation of a competitive raw material base to reduce the cost of domestic products. Solving global problems, including increasing the production of mineral fertilizers to increase soil fertility, should be seen as a way to solve the problem of food security.

Among the promising areas of development of the chemical industry should be noted:

1. Import substitution of chemical products to ensure sustainable growth in the future, to restore the development of organic production.
2. Attracting investments to increase the physical and moral lag of fixed assets of the industry from industrialized countries, updating technological processes, technical re-equipment and opportunities for complete reconstruction, equipping with modern equipment, introduction of low-waste production technologies, optimization of energy consumption.
3. Innovative policy of implementation of the latest scientific and technical solutions, in particular, expansion of the product range of mineral fertiliz-

ers (with microelements, micro- and nanofertilizers), ameliorants, feed mineral additives, etc.
4. Decommissioning of physically worn out and obsolete equipment and commissioning of new equipment that meets the world's leading standards.
5. Optimization of the structure of export-import in the direction of increasing output with higher added value (the range of imports is more diverse).
6. Application of protectionism tools to protect domestic producers, increase motivation and interest in the development of the domestic market.

The draft Strategy for the Development of the Chemical Industry until 2030 contains 10 such priorities: creation of a competitive raw material base, modernization of chemical production, development of intra-industry technological chains based on existing industries, creation of new chemical industries necessary for development of related industries, provision of agro-industrial complex (AIC), effective import substitution, etc. (SKhFR, 2019).

4. Conclusions

Most industries are developing under the influence of not only domestic but also global factors. Their competitiveness and strengthening of export capacities directly determine the country's foreign exchange earnings, the state of the balance of payments and the possibilities of technological renewal. The global dimension of the development of export industries causes a number of threats and challenges that should be kept in mind when developing strategic priorities of industries. The world chemical industry is developing in terms of mergers and acquisitions, the formation of a new regulatory environment, intensification of investment activities, the introduction of innovative technologies.

The domestic chemical industry is characterized by partial cessation of production and physical loss of production capacity, disparities in the production of goods by various sectors of the industry, low level of technology and energy intensity, high level of import dependence, significant foreign trade deficit and gradual decline in the share of chemical exports.

Further development of the industry in the light of the influence of global factors is associated with the processes of import substitution, attracting highly efficient investments, intensification of innovative activity, modernization of equipment, optimization of the structure of exports and imports.

References

ChDNDITEIVKhP. (2020). Cherkaskyi derzhavnyi naukovo-doslidnyi instytut tekhniko-ekonomichnoi informatsii v khimichnii promyslovosti [Cherkasy State Research Institute of Technical and Economic Information in the Chemical Industry]. *Khimichna promyslovist ta khimichnyi rynok Ukrainy u 2020 rotsi: fakty, otsinka stanu, tendentsii, prohnoz* [Chemical industry and chemical market of Ukraine in 2020: facts, assessment, trends, forecast]. http://nditekhim.com.ua/wp-content/uploads/2021/04/2020pidsumky_zakl..pdf [in Ukrainian].

Deineko, L.V. (2018). *Rozvytok promyslovosti dlia zabezpechennia zrostannia ta onovlennia ukrainskoi ekonomiky* [Development of Industry to Ensure the Growth and Renewal of the Ukrainian Economy. Scientific and Analytical Report]. Institute for Economics and Forecasting of the NAS of Ukraine [in Ukrainian].

Falko, Ya. (2019, February 22). Khimprom Ukrainy: v zoni turbulentnosti, abo Khto u nas "vidpovidalnyi" za prodovolchu bezpeku derzhavy? [Ukraine's chemical industry: in a zone of turbulence, or Who is "responsible" for the food security of the state?]. *Golos Ukrainy*. http://www.golos.com.ua/article/314057 [in Ukrainian].

Fortune. (2020). Fortune "Global 500". https://fortune.com/global500

Ishchuk, S., & Koval, L. (2019). Rozvytok khimichnoi industrii v Ukraini ta sviti: porivnialna otsinka [Development of the chemical industry in Ukraine and the world: a comparative assessment]. *Zhurnal yevropeyskoyi ekonomiky, 2*(29), 212–227 [in Ukrainian].

SKhFR. (2019). Soiuz khimikiv ta Federatsiia robotodavtsiv [Union of Chemists and Federation of employers]. *Proekt Stratehii rozvytku khimichnoi haluzi do 2030 roku* [Draft Strategy for the Development of the Chemical Industry until 2030]. https://uteka.ua/ua/publication/news-14-novosti-zakonodatelstva-1-predstavlen-proekt-strategii-razvitiya-ximicheskoj-otrasli-do-2030-goda [in Ukrainian].

SSSU. (2020). State Statistics Service of Ukraine. *Tablytsya "Tovarna struktura zovnishnoi torhivli Ukrainy u 2020 rotsi"* [Commodity structure of Ukraine's foreign trade in 2020]. http://www.ukrstat.gov.ua [in Ukrainian].

Rozwój krajowego przemysłu chemicznego w warunkach globalizacji

Streszczenie. Artykuł poświęcony jest analizie charakterystycznych cech, problemów i perspektyw rozwoju przemysłu chemicznego Ukrainy w perspektywie globalnej. Podano specyfikę funkcjonowania światowego rynku przemysłu chemicznego. Na podstawie rocznego globalnego rankingu „Global 500" i przy użyciu pakietu aplikacji On Front poddano ocenie efektywności wiodące światowe firmy chemiczne, wykorzystując do tego analizę DEA. Zmienne wejściowe to wskaźniki aktywów spółek oraz liczby ich pracowników, a zmienna wyjściowa — wskaźnik dochodu, który pozwolił określić optymalne wykorzystanie zasobów tych przedsiębiorstw, skierowanych na działalność produkcyjną. Zwrócono uwagę na aktualne cechy i zagadnienia związane z działalnością eksportową przemysłu krajowego, który kształtuje się zarówno pod wpływem przemian wewnętrznych, jak i czynników globalnych. Analiza rozwoju branży ujawnia szereg zagrożeń i wyzwań dla jej rozwoju. Na podstawie przeprowadzonych badań uzasadniono perspektywiczne kierunki dalszego rozwoju krajowej branży chemicznej, do których należą procesy substytucji importu, przyciągania wysokoefektywnych inwestycji, intensyfikacja działalności innowacyjnej, modernizacja urządzeń, optymalizacja struktury eksportu i importu.

Słowa kluczowe: przemysł chemiczny, eksport, efektywność, gospodarka światowa, konkurencyjność produktów