

DEVELOPMENT OF THE EXPORT POTENTIAL OF UKRAINE IN THE CONTEXT OF INNOVATIONS OF THE INTERNATIONAL MINING AND METALLURGICAL COMPANIES

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Introduction. High level of globalization in Ukraine demonstrates active processes of its international economic integration in the world economy. Entry into that economic community is accompanied by the fact that Ukraine is gaining its own status which stipulates its competitive edge as well as the possibility to solve social and ecological problems and develop an innovative model of the national economy. In this context, international prospects of the sustainable development of Ukraine basing on the available natural and human capital co-exist with the risks connected with the limited effect of national exporters on the world markets. Cyclicity of the economic development of countries, geopolitical objectives, natural phenomena, and other processes reduce the demand for certain national products that, in general, affects negatively the income of both manufacturers and countries-exporters. Ukrainian mining and metallurgical companies are functioning under conditions of unstable global markets and intensification of export restraints. During the years of independence, valuable minerals and non-ferrous metals became the strategic assets of the export specificity of Ukraine in general and some Ukrainian regions in particular. Despite the economic benefits of Ukrainian mining and metallurgical enterprises on the global product markets, negative ecological impacts of their activity are being accumulated in the regions along with the intensification of risks for the sustainable national development. Thus, monitoring of qualitative and quantitative characteristics of the country's export in the context of innovative potential of the international mining and metallurgical companies, which are current leaders of the national export, is rather topical.

Review of the recent research and publications sources. Scientists, practicing managers, investors, and other interested parties are being constantly focusing on the tasks concerning the development of export potential of Ukraine, its certain industries or enterprises. Foreign authors pay their attention mostly on the technological, environmental, and macroeconomic (e.g. labour market) aspects of the direct-reduced iron production. In particular, those are the papers by Hidetoshi Tanaka [1], Rami Béchara [2], Battle T.P. [3], Valentin Vogl [4], Paul W. Griffin [5], Emrah Karakaya [6], Jakob Mayer [7] and others. Such scientists as L.Ye. Furdychko and Yu.V. Skvarko, L.D. Chalapko, L.A. Peretiatko and S.I. Kozak, A.I. Zubrytskyi, S. Kulytskyi, V.P. Khorolskyi, K.G. Riabykina, N.I. Riabykina and O.O. Lisnichenko and others have contributed greatly in the improvement of leverages over the export potential of the country and mining and metallurgical enterprises of Ukraine. Those studies and propositions may be divided into the groups depending on numerous classification features. For instance, hierarchical level and the interest coverage have stipulated the origin of certain models of the development and practical recommendations of macroeconomic, microeconomic, industrial, and cluster character, e.g. a set of measures of state and microeconomic level to promote export potential of the Ukrainian mining and metallurgical enterprises (MME) proposed by L.Ye. Furdychko [8]. Emphasis is placed on the stimulation of internal consumption of the MME products, increasing efficiency of the innovative business management; however, little attention is paid to the prospects of Ukrainian enterprises in the external markets taking into account current world tendencies.

Transition to the production of commodities with high added value, changes in specialization of the national economy, and growing competitiveness of the Ukrainian products by reduction of the production

resource efficiency are the popular methods to increase current Ukrainian export. In particular, L.D. Chalapko with his co-authors [9] highlights the possibilities open for the exporters owing to the signing the free trade agreement with the UN. In this context, no attention is drawn to the risks connected with the regulation of the access of traditional exporters (minerals, non-ferrous metals) to the international markets.

One should agree with A.I. Zubrytskyi [10] who mentions considerable obstacles on the way of rapid transition to a high-technology structure of national export, i.e. poor quality of the institutional environment and geopolitical problems. As a result, inefficient use of budgetary funds for supporting new industries and enterprises is observed. Thus, we consider that it is expedient to analyze possibilities of revising strategies aimed at favouring innovative development of the raw-material export industries of Ukraine.

S. Kulitskyi [11] specified current problems of the Ukrainian mining and metallurgical complex (MMC) and ways of their solution; in particular he emphasized considerable changes in the business environment due to the military aggression of the Russian Federation in Eastern Ukraine. Reduction of the mineral and raw-material base and nonavailability of metallurgical production facilities within the occupied territory stipulate topicality of the search for possible innovative solutions in the sphere of quality and mastering of new types of the core products (new products of mineral dressing).

V.P. Khorolskyi [12] stresses the necessity of improving the quality of Ukrainian mining and metallurgical enterprises, i.e. the ones associated with the international vertically integrated holding *Metinvest*. It is proposed to develop a system of quality control for iron-ore products to meet high requirements of the European market. In this context, policy of the countries-recipients as for the import restriction for Ukrainian products is not taken into consideration.

Much attention is paid not only to innovations but also to environmental and social aspects of the development of both enterprises and mining regions [13]. Status of mining and concentration as well as metallurgical enterprises is defined by the staff number, paid taxes, development of the related economic activities, corporate social responsibility etc. That status increases the priority in directing state stimulating measures at the export activities of the mining and metallurgical enterprises on the basis of their current product portfolio.

K.H. Riabykina proves the necessity of business model transformation for iron-ore mining and concentration integrated works (MCIW) [14]. Excess of the production facilities (in terms of iron-ore product manufacturing), relative to the domestic demand for the product, results in the MCIW dependence on the condition of external markets of certain countries and world tendencies of economic growth. K.H. Riabykina singles out following basic parameters of the business-model transformation of the integrated works: increase in the innovative level of production; manufacturing of the competitive products with a considerable share of added value; consolidation of the positions in the world markets in terms of the world economic globalization; provided balance of corporate and national interests; increasing social responsibility of a business. In this context, manufacturing of the innovative product – direct-reduced iron, being increasingly demanded for by the EU countries, is considered impossible due to high earth silicon content (8-9 %) and low iron content (65 %) as well as economic inexpediency. However, that estimation of the prospects of direct-reduced iron production is not confirmed by the studies; thus, there arises a task of searching for and agreeing the corresponding expert opinions.

Task statement. Despite the constant and focused attention to the issues concerning stimulation of production and export of high value-added products, strategic problems of the development of enterprises of raw-material industries are still rather topical. Thus, we consider that to determine possible prospects of the Ukrainian export development, it is required to study prerequisites of the mining and metallurgical enterprises' mastering the innovative product manufacturing and the conditions of the corresponding global markets.

The paper solves the problem of determining prospective trends in the development of export potential of Ukraine taking into consideration possibilities of the innovative development of international mining and metallurgical companies. Those objectives imply solving following problems: - to evaluate export specificity of Ukraine with the determination of the status of mining and metallurgical companies; - to characterize innovative products of mining and metallurgical companies which favour sustainable development of the country; - to analyze conditions of the global market of the innovative product (direct reduced iron); - to analyze tendencies of the development of the world steel market involving determination of its main consumers. The research was carried out considering the content of a model of innovative development of national economy which is to provide sustainable development of the country. Basing on the processes of the international economic integration of the countries and high globalization level, the priority is given to

export activity of the national enterprises to determine features of the national export specificity. The research database is formed by the statistic information of the State Statistics Service of Ukraine, publications of the World Steel Association, scientific publications on the problems of the direct iron reduction technologies, and other specialized information materials (interviews, news, analytics). Following research methods are applied to solve separate problems: systematization and scientific generalization; analysis; comparison.

Basic material and results. High level of the international economic integration of Ukraine stipulates dynamics of its export-import operations. According to the data by the State Statistics Service of Ukraine [15], Ukrainian enterprises conducted foreign economic transactions with 89 countries worldwide in 2018; those countries were characterized by different level of economic development and geopolitical influence, different needs in goods and services, and their belonging to different economic associations. Within the period of 2016-2018, foreign goods and services trade was characterized by the increasing absolute volumes of export and import (i.e. in 2018, export estimated USD 57.3 bln including USD 10.7 bln to the CIS countries and USD 23.1 bln to the EU ones). Nevertheless, the period of 2017-2018 demonstrated negative balance stipulating the value of the export-import coverage ratio at the level of 0.9. Efforts made by different state and international bodies facilitating the export activity are one of the factors stipulating the growth of the number of enterprises exporting their products for 1,073 units and services for 336 units (in 2018 compared with 2016). Dynamics of the amount of Ukrainian foreign economic activity (FEA) entities shows the expanding practice of the establishing international trade relations taking into consideration interests of the countries-partners. In terms of the general number of enterprises (57,491) conducting FEA, exporters account for 41.2 % while importers account for 58.8 %; that reflects considerable interest to the import activity and requires in-depth assessment from the viewpoint of the import influence on the development of national economic potential and reaching positive changes in its ecological and social spheres.

As for geographical export structure, it should be noted that a share of the CIS countries in general export amount reduced from 20.7 % in 2016 down to 18.7 % in 2018 while a share of other countries increased up to 81.3 %, i.e. in terms of the UN countries, that value grew up to 40.3 %. A share of the US countries in goods export increased from 32 % in 2014 up to 42.6 % in 2018; in terms of services export, a share experienced its decline from 35 % down to 31 %. Diverse situation is observed with the balance of trade operations with the UN countries: balance of the commodity trade became negative while service trade balance became positive (see Table 1). Export of services to the CIS countries provides the greatest trade success of the Ukrainian FEA entities. The largest negative balance is also characteristic for the commodity trade with the CIS countries. Thus, the EU countries continue gaining a status of the priority FEA partner of Ukraine; however, the CIS countries are still attractive for the FEA entities which have a long history of business relations and/or make up a vertically integrated system.

Table 1

Structure and balance of the Ukrainian external trading of goods and services, 2016-2018 (based on [15])

	Export, %		Import, %		Balance, USD bln	
	2016	2018	2016	2018	2016	2018
Goods and services						
CIS countries	21.6	18.7	20.7	21.9	0.52	-3.18
Other world countries	78.4	81.3	79.3	78.1	0.03	-3.04
among them, EU countries (28)	35.1	40.3	43.9	41.8	-3.73	-3.47
Goods						
CIS countries	16.6	14.8	21.8	23.1	-2.53	-6.18
Other world countries	83.4	85.2	78.2	76.9	-0.35	-3.67
among them, EU countries (28)	37.1	42.6	43.7	40.6	-3.64	-3.06
Services						
CIS countries	37.8	31.8	12.6	10.9	3.06	3.01
Other world countries	62.2	68.2	87.4	89.1	1.49	2.32
among them, EU countries (28)	30.5	34.2	45.5	53.2	0.58	0.62

In terms of top-7 countries of the preferential countries-partners of Ukraine, the Russian Federation (RF) still ranks first, but its share in the Ukrainian export and import starts reducing from the moment of the

AR Crimea annexation by the RF and the beginning of military operations in Eastern Ukraine (Fig. 1). Major share of the Ukrainian export revenues comes from the enterprises of Poland, Italy, China, and Turkey. Considerable volumes are exported from China, Germany, Poland, and Belarus; in 2018, Italy replaced France in the list of leading countries-importers.

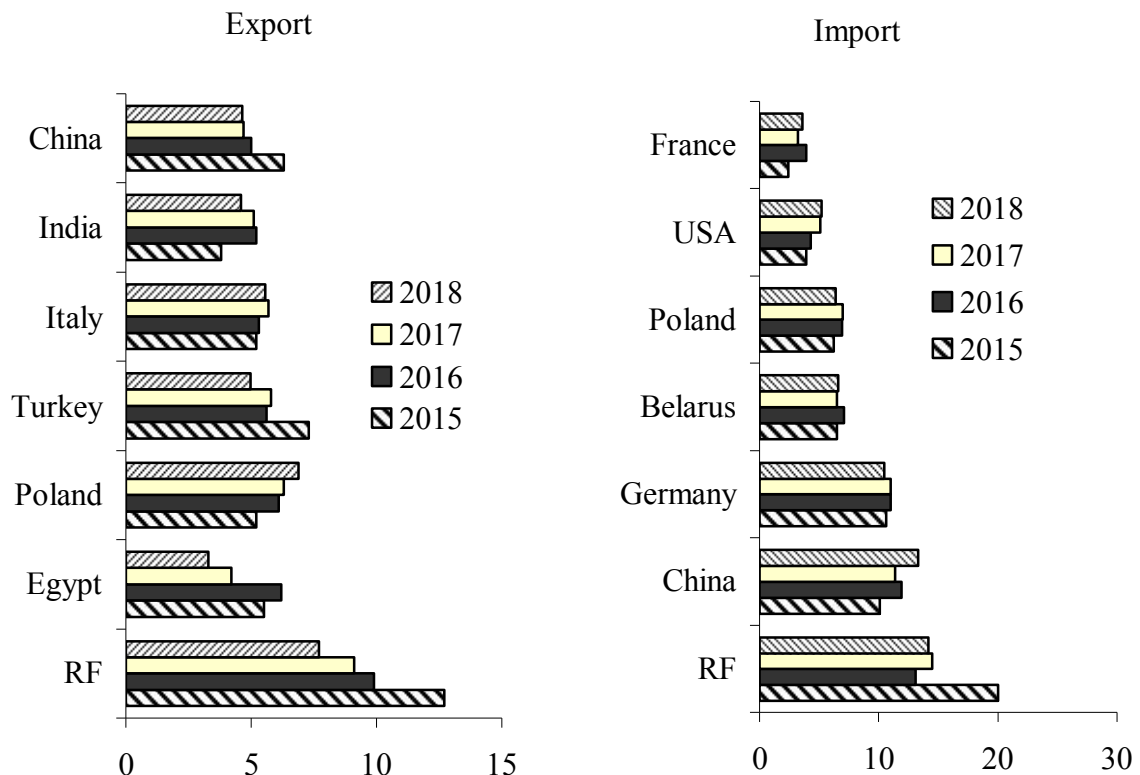


Fig. 1. Top-7 countries-partners in the foreign Ukrainian commodity trade (based on [15])

Results of trading with India (USD 1559.2 mln; - 5.2 % compared with 2017), Egypt (USD 1460.2 mln; -16.8 %), the Netherlands, Spain, Moldova, Iraq (USD 644 mln; +34,4 %) and other countries demonstrate the most positive balance in 2018, those are the countries which majority is the developing ones and the ones with transition economy. The most negative balance in 2018 is the result of trade relations with China (USD -5408. mln; +49.9 % compared with 2017), the Russian Federation (USD -4437.8 mln; +35.9 %), Germany (USD -3775.0 mln; +2.3 %), Belarus (USD -2482.7 mln; +20,4 %), the USA, Switzerland, France, Lithuania, Japan (USD -505.6 mln) and other countries being mostly the developed ones. Thus, not only the access of Ukrainian goods to markets of certain countries but also stable increase in the export volumes and positive balance is rather important. In this case, state activities in the sphere of the development of international economic relations as well as the operation of enterprises-exporters aimed at the increasing competitiveness of their own products in the market of a receiving country are rather topical. There are the latter results in the actualization of searches for the innovative solutions to form new want-satisfying qualities of the product and reduce its manufacturing and transportation costs (i.e. using the benefits of international labour specialization and potential of global markets).

Formation of negative balance of Ukraine in 2018 was effected by the import of the following product groups: mineral fuel, oil and oil products (23.4 % in the general import volume; +15.3 % before 2017), nuclear reactors, boilers, machines (11.3 %; +12.1 %), electric machines (9.6 %; +32.8 %), means of ground transport except the railroad ones (7.4 %; +6.5 %), plastics, polymer materials (4.7 %; +9.8 %), pharmaceutical products (3.4 %; +10.2 %), ferrous metals (2.4 %; +20.4 %), different chemical products (2.4 %; +7.6 %).

In 2018, structure of the Ukrainian export showed the prevailing share of raw material products (see Table 2), i.e. ferrous metals (21 %; +14.9 %), which, along with ore, slag, and ash (6.4 %; +10.9 %), make up the main products of mining and metallurgical complex commodities. Those raw material products are used by other countries to manufacture products with higher added value. Export of Ukrainian ferrous-metal products is only 2.3 %; however, its volume has increased by 23.8 % within a year.

Apart from metals, leading items of Ukrainian export are represented by crops (15.3 %; +11.4 %) and

seeds and oil plant fruits (4.1 %; -5.1 %); they also cannot be considered as the export asset with long-term and stable characteristics due to climatic changes, efficiency of production processes, and logistic problems of agricultural business. Leading positions of the following product groups are the additional fact to tell about the raw-material content of the Ukrainian export: wood and wood items (32 %; +23.9 %) and food-industry residues and waste (2.6 %; 16.5 %). Only two groups of value-added products are represented among the export ones: electric machines (6.2 %; +15 %) and nuclear reactors, boilers, machines (3.6 %; -0.2 %).

Table 2

Structure and dynamics of the Ukrainian product export (based on [15])

HS code and name of products	Export			
	2017, USD mln	2018		
		USD mln	in % before 2017	in % to the general volume
Total	43264.7	47335.0	109.4	100.0
including				
72 ferrous metals	8666.2	9937.0	114.7	21.0
10 crops	6501.1	7240.6	111.4	15.3
26 ores, slag, and ash	2735.7	3035.3	110.9	6.4
85 electric machines	2548.8	2930.4	115.0	6.2
12 seeds and fruits of oil plants	2060.1	1954.1	94.9	4.1
84 nuclear reactors, boilers, machines	1728.0	1724.3	99.8	3.6
44 wood and wood items	1204.3	1492.5	123.9	3.2
23 food-industry residues and waste	1051.2	1224.8	116.5	2.6
73 ferrous-metal products	896.5	1109.9	123.8	2.3
28 inorganic chemistry products	780.6	883.2	113.2	1.9
27 mineral fuels; oil and oil products	790.2	861.3	109.0	1.8
Others (total)	14302	14941.6	104.5	31.6

In terms of the identified situation with the product structure of the Ukrainian export and leadership of the MMC complex, there are several questions to be discussed:

- whether it is necessary to support the MMC enterprises and give them preferences compared with other types of activity or the ecological and social needs of communities;
- what types of activity may become the future leaders of the Ukrainian export and what measures should be implemented by different interested and responsible entities to develop them;
- what innovative possibilities the MMC enterprises have for supporting their potential taking into account the necessity of providing sustainable national development.

Analyze one of the possible variants of the development of mining and metallurgical enterprises which is based on the innovative technologies of the production activity. A technology to produce direct reduced iron is the already known innovative trend in the development of world metallurgy; that technology makes it possible to get two basic products: metalized direct reduced iron (DRI) pellets and hot briquetted iron (HBI). Those products are characterized by high, more than 90%, iron content. It should be noted that to make steel, cast iron, metal scrap, and direct reduced iron are used in the proportions of 64%-31%-5% respectively. World tendency is to increase demand for high-quality steel, to decrease supply of high-quality metal scrap, and to rise level of ecological responsibility of the cast-iron manufacturers applying blast furnaces. According to the conclusions by *Hares Engineering* and *Kobe Steel*, all the iron-ore concentrates (iron content is more than 60 %) of the CIS countries, i.e. made of oxidized ores, are suitable for the direct reduced iron making in the form of granulated iron according to ITmk3 technology [16]. That technology does not require use of coking coal that is topical for Ukraine as the corresponding deposits are located within the occupied Donbas territories. Advantages of the ITmk3 technology are as follows: considerably lower volume of the natural gas use comparing to the Midrex technology (products - DRI); reduced emissions of harmful substances and greenhouse gases comparing to the blast-furnace process. Use of granulated iron instead of cold pig iron (up to 20 % in the burden mix) in electric furnaces helps reduce the melting time by 3 minutes, cut energy consumption by 5 %, and increase furnace output by 5 %.

Thus, the perspectives of the technology of direct iron reduction is stipulated by the following factors: high still quality (no harmful impurities; expanding range of metal use); reducing needs of still-makers in the purchase of high-quality metal scrap (costs for preparation).

According to the *World Steel Association* (WSA), world DRI production is growing: DRI output in 2017 was 88.7 mln tons that is by 10.3 mln tons more (13.2 %) compared with 2016 and by 20.9 mln tons more (31.03 %) compared with 2008. Middle East and Asia are the leaders in that production (Fig_2) [17].

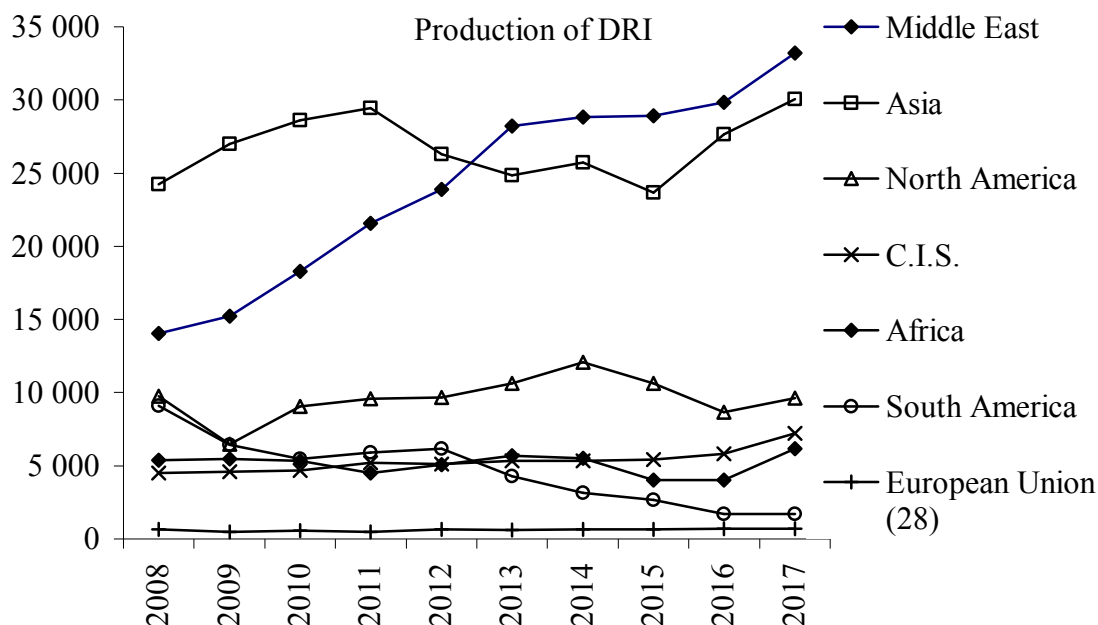


Fig. 2. Dynamics of the world production of DRI, thous. t (based on [17])

In 2016-2017, Africa and the CIS (the RF) demonstrated the highest positive production index; however, their outputs are by almost 5 times lower than the leaders' ones which continue growing their production by 8-11%. India (29.5 mln t) and Iran (19.4 mln t) are the countries-leaders in the DRI production (Table 3); next goes the Russian Federation, Mexico, and Saudi Arabia showing a third of that result (4.6-7.2 mln t). The greatest dynamics within the period of 2016-2017 is observed in Egypt (+78%). During the period of 2008-2017, the greatest production output was observed in 2017 (88.7 mln t). According to the forecasts by *Midrex*, within the following 20 years, world production of direct reduced iron may increase twice but only in terms of the intensified environmental liability of metallurgical companies with traditional technologies and enough available natural gas volumes as the technological raw material [18].

Table 3

TOP-10 Production of direct reduced iron, thous. t (based on [17])

	2008	2010	2012	2014	2016	2017	2017/ 2016
India	20 914	24 931	23 438	24 542	26 982	29 505	1.094
Iran	7 399	9 350	11 582	14 551	16 013	19 401	1.212
Russia	4 500	4 700	5 125	5 350	5 820	7 200	1.237
Mexico	6 012	5 368	5 586	5 979	5 306	6 011	1.133
Saudi Arabia	4 970	5 510	5 660	6 460	5 119	4 812	0.940
Egypt	2 643	2 965	3 068	2 882	2 618	4 667	1.783
United Arab Emirates	-	1 180	2 699	2 409	3 479	3 608	1.037
Qatar	1 681	2 250	2 420	2 549	2 506	2 548	1.017
United States	260	-	-	1 300	1 810	2 000	1.105
Canada	704	600	842	1 550	1 399	1 608	1.149

Within the period of 2008-2017, world DRI export volume demonstrated its general increase; in terms of the period years, it fluctuates inconsiderably from 7 to 9.7 mln t. In 2017, world DRI export increased by 25.7 % compared with 2016. The CSI, North America, Middle East, and South America are traditional regions-leaders with positive DRI export dynamics (Fig_3). Producers of the RF (2.3 mln t), Trinidad and Tobago (1.7 mln t), and Venezuela (1.2 mln t) provided the greatest export volumes (see Table 4). Oman, the USA, Malaysia, and India formed the next group of exporters with the volumes of 0.5-0.9 mln t. Entry of Belgium (with the volume of 113 thous t) to the top-10 of export leaders is rather demonstrative. The USA (3.5 times), India (90.8 %), and Oman (55.6 %) demonstrate the most positive dynamics.

World DRI import experiences its increase from 7.1 mln t in 2008 up to 10.1 mln t in 2017; production index in 2017/2016 was 37.7 % (Fig. 4). In terms of geographical structure of the import, the leaders are as follows: countries of the UN, North America, Middle Asia, and Asia (Table 5). The USA, Saudi Arabia, and Italy imported the most share in the volumes of 1.2-1.8 mln t. Import within the volumes of 0.4-1.0 mln t/year is characteristic for the developed countries, i.e. Germany, Spain, and Austria. Mexico and North Korea are the other major exporters. Austria (4.7 times), Turkey (3.2 times), France (3.6 times), and Belarus (2.6 times) demonstrated the most positive annual import dynamics.

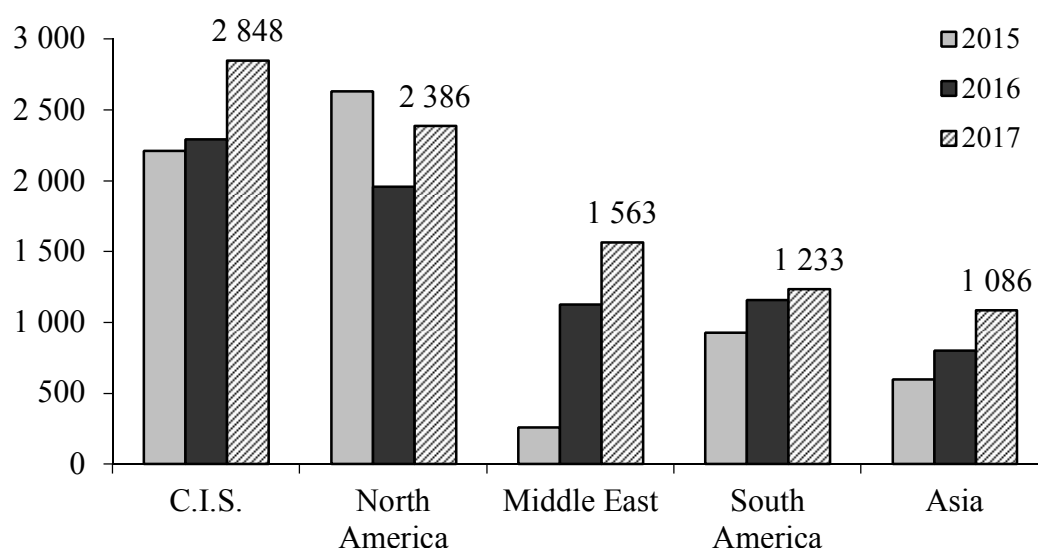


Fig. 3. Dynamics of the world DRI export, thous. t (based on [17])

Table 4

TOP-8 Exports of the direct reduced iron, thous. t (based on [17])

	2008	2010	2012	2014	2016	2017	2017-2016	2017/2016
Russia	2 482	1 915	2 132	2 192	2 289	2 848	559	1.244
Trinidad and Tobago	1 837	2 266	2 414	2 784	1 708	1 746	38	1.022
Venezuela	2 875	1 802	2 117	56	1 156	1 233	77	1.067
Oman	0		916	184	561	873	312	1.556
United States	28	9	8	4	178	640	462	3.596
Malaysia	322	473	861	703	522	570	48	1.092
India	29	69	126	167	262	500	238	1.908
Belgium	1	11		0	0	113	113	-

Modern structure of the global market of direct reduced iron is almost stable as its production is possible in the countries with considerable volumes of the affordable energy resource – natural gas [19, 20]. Strategic orientation of metallurgical enterprises to the production of high-quality steel results in constant demand for the direct reduced iron (DRI pellets). DRI use reduces negative environmental impact of

metallurgical production; however, the factor stimulating the DRI production is represented by the policy of sustainable development of countries – the policy to stimulate the increase in a share of the metal recycling (up to 40 % in the developed countries).

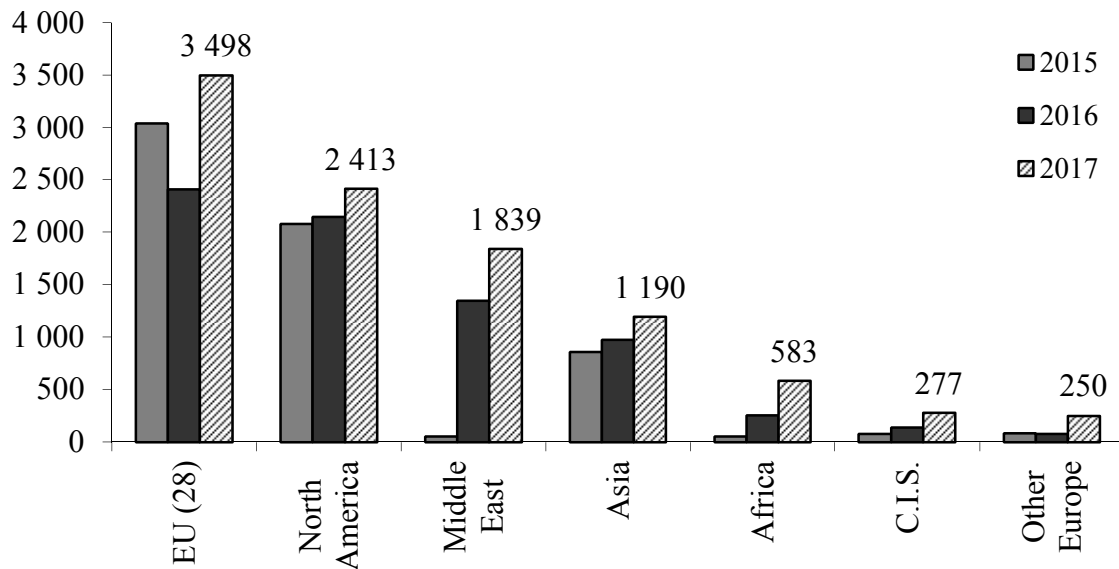


Fig. 4. Dynamics of the world DRI import, thous. t (based on [17])

Table 5

Dynamics of the world direct reduced iron import, in terms of certain countries, thous. t (based on [10])

	2008	2010	2012	2014	2016	2017
United States	2 555	1 643	2 762	2 392	1 598	1 789
Saudi Arabia	0	91	0	126	1 255	1 713
Italy	362	241	509	663	1 122	1 123
Germany	28	425	127	537	590	951
Mexico	5		185	159	549	577
Spain	564	578	441	596	299	426
Austria	41	0	69	42	89	425
South Korea	365	676	439	636	383	417
Turkey	88	14	5	46	77	250
France	78	47	34	33	59	198
Byelorussia	82		51	90	70	179
Portugal	0	6	27	0	123	129
Belgium	1	23	18	12	43	125
Other CIS	0		0	30	22	96
Indonesia	290	156	350	37	3	59
Japan	76	226	84	124	25	9
Denmark	3	2	2	36	13	6
Ukraine	530	346	260	39	45	2
United Kingdom	0	79	194	0	16	1
Canada	286	417	160	40	1	0
Argentina	0	118	32	38	0	0

The history of modern Ukrainian mining and metallurgical business had some initiatives as for the organization of DRI products manufacturing. For instance, Ingulets Mineral and Concentration Integrated Works (MCIW), Poltava MCIW, Southern and Central MCIW considered the possibility of manufacturing direct reduced iron using the ITmk3 technology [21]. Those projects were implemented at different stages:

from the preliminary arrangement concerning construction operations to the technical and economic assessment of the construction of certain units and the elaborated business-plan of the whole plant. Perspective production facilities varied from 0.5 up to 3 mln t per year. Taking into consideration the needs of Ukrainian metallurgical enterprises in direct reduced iron, capital investment of those projects (more than USD 300 mln) would be repaid within rather short period of time. Perspectives of the ITmk3 technology were estimated as rather profitable ones (cast iron product with high iron content) in terms of the development of Kryvyi Rih MCIW reserves of oxidized ores. Additional benefit of those projects is in the use of ordinary coal grades, possibility to produce technological equipment in Ukraine, electric power generation owing to heat being the by-product of the production process. However, those projects were not implemented, particularly, due to the reasons of global recessionary phenomena, and Ukrainian manufacturers continued importing direct reduced iron of Lebedynskiy MCIW (the Russian Federation [22, 23]. Reducing import from the RF (beginning from 2013), increasing metal scrap deficit in the Ukrainian market, decreasing demand for the iron-ore raw material with low iron content in the world market are the factors of the renewed business interest in the direct reduced iron in Ukraine.

Traditionally, different measures to improve product quality are considered as the strategy of protecting mining and metallurgical companies against the risks of price fluctuations in the global market of iron-ore raw material and protecting their status as the leading exporters. For instance, market of pellets to produce direct reduced iron is the prioritized target segment for the Central Mining and Concentration Integrated Works (*Tsentrалnyi GZK PJSC*) [24]. In particular, investments are channeled to modernize its pellet factory involving purchase of Canadian technological equipment and implementation of automated system of industrial control. Currently produced concentrate of the Central MCIW with iron content of 68.2 is sold in the countries of Central and Eastern Europe; pellets of better quality will be sold in the markets of Western Europe and Japan. CEO of *Tsentrалnyi GZK PJSC* mentioned manufacturers of Brazil, Russian, and other Ukrainian producers as their main competitors in the European market [25]. While evaluating current market status of the integrated works in the international markets, negative effect of the tariff raising for freight transportation by *Ukrzaliznytsia* is emphasized. As a result of that raising, the company shutdown, loss of national export incomes, break of contracts with European consumers, loss of market, and deterioration of the national image are predicted. Attention is also paid to high mineral royalty as well as other high tariffs and taxes for mining business comparing to other countries.

It should be pointed out that *Tsentrалnyi GZK PJSC*, along with *Pivnichnyi GZK PJSC* and *Ingulets'kyi GZK PJSC*, belongs to the international vertically integrated holding *Metinvest Ltd* that stipulates the possibility of mining and concentration integrated works to form their own import strategy or sets new tasks taking into account the development of export potential of metallurgical plants of the holding. In 2018, markets of iron-ore products by the *Metinvest* holding enterprises demonstrated positive dynamics and diversification of the export to South Africa, Mexico, Japan, the Netherlands, and Great Britain (in addition to the traditional consumers – countries of Eastern Europe). Modern European trend in the iron-ore raw material (IORM) market is the increasing requirements for the high-quality IORM. In particular, that concerns the premium DRI-pellet market being a target one for the holding enterprises. Nowadays, *Metinvest* holding is implementing corresponding projects to modernize technological facilities at *Tsentrалnyi GZK* and *Pivnichnyi GZK* to start DRI-pellets production from 2020. Thus, entry to new market segments and manufacturing of innovative high-quality products are considered to be the directions for strategic development which will provide more stable competitive position of iron-ore and metallurgical enterprises of the holding in the international markets.

According to marketing director of the *Metinvest* holding [26], increasing world demand for the finished steel in 2018, even in terms of trade restraints and problems of supply logistics, favoured the growing number of the production plans of the holding enterprises. Stable positive dynamics of the internal Ukrainian market (4-5 % per year) is observed due to the activation of state infrastructure programs and implementation of private projects on modernization of main production facilities. There are following priority strategic consumers: ship-building companies; machine-building companies forming their own portfolio of orders as for the projects of railway carriage fleet renovation; metal-structure manufacturers which are certified according to European quality system and export support program and have possibility to purchase rolled-metal products on special terms. Among other things, it is stressed that the solar and wind energy markets have certain positive effect on the activity results of the holding which is developing and increasing its scope of construction operations. Strategically and geographically, the *Metinvest* holding is

oriented to European and Ukrainian markets of metal products along with the diversification of external markets (presence in the markets of the Near East, EN countries, and South-East Asia which compensates its exit from the RF market). Improved service level and product quality stipulating the content of the holding investment programs are at the heart of its competitive strategy. Service improvement means implementation of customer relationship management (CRM), use of adaptive contract forms, increase in supply velocity, optimization of logistics by opening new metal distribution centers making it possible to cover maximally the retailing segment. Improved product quality is provided by the investments in the production equipment modernization and development (purchase) of new production facilities.

Thus, production of high-quality iron-ore raw material depends on the development rates of the world metal products markets. According to the forecast by the World Steel Association, world demand for steel is going to reach 1805.7 mln t (+1,7 %) in 2020 with the following countries to be leaders of that growth: Asia and Oceania (+1270 mln t), the NAFTA (+142.6 mln t), the EU -28 (+168.6 mln t), the CIS (+59.2 mln t), Central and South America (45.5 mln t). Increasing demand in African countries and other European countries will reach +37.2 and +34.5 mln t respectively [27]. China remains to be a main catalyst of the steel demand that is provided, first of all, by the implementation of new construction standards stipulating increase in metal structure specific weight by 5 % in the material of new buildings [28]. In other developed and developing countries, governments also focus their attention on the intensification of investment activity in infrastructural, energy, transportation, and communication projects. However, that governmental activity is connected with the complex political solutions, i.e. compensation of a part of the cost of civil construction projects in terms of problems with the state budgetary recharge. There are still high risks in the sphere of car making and manufacturing of different-purpose machines. Strained international trade relations and other geopolitical problems are traditionally included into the main reasons of slow rate of the world steel demand growth. Despite the mentioned facts, experts of the World Steel Association believe that the world steel demand will be stable irrespective of the uncertainty of the world economic environment.

There are only two Ukrainian enterprises, *Metinvest Holding LLC* and *ISD* (Industrial Union of Donbas) among the leading 108 world metallurgical companies produced more than 3 mln t of steel; in 2016-2018, those two companies reduced their supplies to the world market with the following deterioration of their rating positions (see Table 6).

Table 6

Dynamics of the positions of Ukrainian companies in the rating of the largest world steel-makers in 2016-2018 [30]

	Production output, mln t			Rating position		
	2016	2017	2018	2016	2017	2018
Metinvest Holding LLC	10.34	9.59	9.37	37	42	42
ISD	4.61	3.41	3.66	74	87	96

Since MMC companies are not represented as the key players in the state export strategy being considered as the suppliers of raw material for export products with higher added value, MMC companies may face the lack of (or considerable restraints in) the governmental measures to support their activities. That is stipulated by reconsideration of the status of MMC companies as an entity of the formation of socioeconomic and environmental results of the national activity in general. Contrary to that fact, it should be noted that according to the Oxford Economics estimations [29], global steel-making industry has considerable effect on the world economy. For example, world metallurgical industry productivity per one worker is more than USD 80 thous. being three times more than the average one in all the world economy industries. In terms of each added value dollar of the metallurgical industry, 2.50 dollars of added value are created additionally in other industries of the world economy as a result of purchase of raw material, goods, energy, and services. 13 jobs throughout the whole supply chain are supported more per each two jobs in the metallurgical sector. Generally, about 40 mln people work in the global metallurgical industry generating more than USD 1.2 trn; economic activity of that industry expands to different sectors and countries which are far from the main steel-making areas.

Thus, effect on the export potential of mining and metallurgical companies of Ukraine should be well-considered making it possible to agree economic interests of mining and metallurgical companies in the

external markets, interests of Ukrainian export-oriented companies of other industries, and interests of the society in general concerning the sustainable development.

Conclusions. Ukraine's getting competitive advantages in the world product markets, intensification of its role in the world economy, and improvement of the living standards of the Ukrainians may be provided by the innovative development of resource-based industries of the national economy. List of main strategic tasks for the development of export potential of Ukraine and its basic export industry (iron-ore, mining-metallurgical) should include the following:

- improvement of technological conversion of the mined ore to produce pellets with high iron content;
- development of the production of direct reduced iron applying the least resource-intense technology;
- production of the high-quality metal using direct reduced iron;
- stimulation of the internal consumption of high-quality metal to produce Ukrainian high-technology products which will form the basis of the renewed export portfolio of Ukraine.

To provide the tasks completion, it is required to solve numerous problems, i.e. to carry out further geological prospecting of the natural and shale gas reserves in Ukraine, to increase gas extraction with its sending to the internal market, and to give preferences to the enterprises which will be involved in the high-quality metal production and its further use to manufacture world-market competitive products.

Development of economic and organizational basis to promote development of the enterprises which activity will be connected directly or indirectly with both direct reduced iron and use of high-quality steel to produce export-oriented products with high value-added is the topical aspect of further studies.

REFERENCES:

1. Tanaka, Hidetoshi. (2015). Resources Trend and Use of Direct Reduced Iron in Steelmaking Process. *Kobelco technology review*, 33, FEB. URL: https://www.kobelco.co.jp/english/ktr/pdf/ktr_33/001-007.pdf [in English].
2. Rami Béchara, Hamzeh Hamadeh, Olivier Mirgaux, and Fabrice Patisson. (2018). Optimization of the Iron Ore Direct Reduction Process through Multiscale Process Modeling. *Materials (Basel)*, Jul, 11(7):1094. URL: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6073552/> [in English].
3. Battle T.P. (2014). Sustainability in Ironmaking: The Rise of Direct Reduction. Mackey P.J., Grimsey E.J., Jones R.T., Brooks G.A. (eds) *Celebrating the Megascale*. Springer, Cham. URL: https://link.springer.com/chapter/10.1007/978-3-319-48234-7_25 [in English].
4. Valentin Vogl, Max Åhman, Lars J. Nilsson. (2018). Assessment of hydrogen direct reduction for fossil-free steelmaking. *Journal of Cleaner Production*, 203, 736-745. URL: <https://doi.org/10.1016/j.jclepro.2018.08.279> [in English].
5. Paul W. Griffin, Geoffrey P. Hammond. (2019). Analysis of the potential for energy demand and carbon emissions reduction in the iron and steel sector. *Energy Procedia*, Volume 158, 3915-3922. URL: <https://www.sciencedirect.com/science/article/pii/S1876610219308938/pdf?md5=2b21d6fe452ee31de5fc9f101136f954&pid=1-s2.0-S1876610219308938-main.pdf> [in English].
6. Emrah Karakaya, Cali Nuur, Linda Assbring. (2018). Potential transitions in the iron and steel industry in Sweden: Towards a hydrogen-based future? *Journal of Cleaner Production*, Volume 195, 651-663. URL: <https://www.sciencedirect.com/science/article/pii/S0959652618314823/pdf?md5=38368b74b16f86951b097f3f5c0ebb93&pid=1-s2.0-S0959652618314823-main.pdf> [in English].
7. Jakob Mayer, Gabriel Bachner, Karl W. Steininger. (2019). Macroeconomic implications of switching to process-emission-free iron and steel production in Europe. *Journal of Cleaner Production*, Volume 210, 1517-1533. URL: <https://www.sciencedirect.com/science/article/pii/S0959652618335224/pdf?md5=10b196f63ce2d2d1463583076eab88c6&pid=1-s2.0-S0959652618335224-main.pdf> [in English].
8. Furdychko, L.Ye. & Skvarko, Yu.V. (2016). Suchasnyi stan ta perspektyvy metalurhiinoi haluzi Ukrainy: finansovi pokaznyky rozvytku, eksport-import produktsii [Modern state and prospects of metallurgical industry of Ukraine: financial indices of the development, export-import of the products]. *Sotsialno-ekonomichni problemy suchasnoho periodu Ukrainy – Social and Economic Problems of modern Period of Ukraine*, 3, 102-106. URL: http://nbuv.gov.ua/UJRN/sepspu_2016_3_22 [in Ukrainian].

9. Chalapko, L.D., Peretiako, L.A. & Kozak, S.I. (2016). Eksportnyi potentsial Ukrainy: problemy i perspektyvy realizatsii [Export potential of Ukraine: problems and prospects of its implementation]. *Naukovyi visnyk NLTU Ukrainy – Scientific Messenger of NLTU of Ukraine*, 26.2, 247-253. URL: http://nbuv.gov.ua/UJRN/nvnltu_2016_26 [in Ukrainian].
10. Zubrytskyi, A.I. (2015). Eksportnyi potentsial Ukrainy u konteksti porivnialnykh perevah [Export potential of Ukraine in the context of comparative advantages]. *Ekonomika i prohnozuvannia – Economy and Forecasting*, 1, 140-154. URL: http://nbuv.gov.ua/UJRN/econprog_2015_1_13 [in Ukrainian].
11. Kulytskyi, S. (2015). Problemy rozvytku ukrainskoho hirnycho-metallurhiinoho kompleksu na suchasnomu etapi [Problems of the development of Ukrainian mining and metallurgical complex at the current stage]. *Ukraina: podii, fakty, komentari. – Ukraine: Events, Facts, Comments*, 14, 37-49. URL: <http://nbuviap.gov.ua/images/ukraine/2015/ukr14.pdf> [in Ukrainian].
12. Khorolskyi, V.P., Khorolska, O.V. & Khorolskyi, K.D. (2014). Stratehiia upravlinnia yakistiu produktsii na korporatyvnykh pidpriemstvakh hirnycho – metallurhiinoho klasteru rehionu [Strategies to control product quality at corporate enterprises of mining and metallurgical regional cluster]. *Kachestvo myneralnoho syria – Quality of Mineral Raw Material*, 456-469. URL: http://nbuv.gov.ua/UJRN/kachmin_2014_2014_63 [in Ukrainian].
13. Pashkevych, M.S. (2011). Dyversyfikatsiia diialnosti vuhledobuvnykh pidpriemstv v konteksti rozvytku depresyvnnykh rehioniv Ukrainy [Diversification of the activity of coal mining enterprises in the context of the development of depressed regions of Ukraine]. *Ekonomichnyi visnyk Natsionalnoho hirnychoho universytetu – Economic Messenger of the National Mining University*, 3, 11-17 [in Ukrainian].
14. Riabykina, K.H., Riabykina, N.I. & Lisnichenko, O.O. (2017). Napriamky transformatsii biznes-modeli yak mekhanizmu zabezpechennia efektyvnosti upravlinnia kapitalom hirnychozbahachuvalnykh pidpriemstv [Trends in transformation of a business-model as a mechanism to provide efficiency of capital control for mining and concentration enterprises]. *Biznes Inform – Business Inform*, 1, 172-179. URL: http://nbuv.gov.ua/UJRN/binf_2017_1_28 [in Ukrainian].
15. Statystychnyi zbirnyk «Zovnishnia torhivlia Ukrainy» 2018 [Statistic collection “External trade of Ukraine” 2018]. *Ukrstat.gov.ua.* URL: http://www.ukrstat.gov.ua/druk/publicat/kat_u/2019/zb/06/zb_ztu_2018.pdf [in Ukrainian].
16. Razaz, Yunes, Opryshko, I.A. & Loboda, P.I. (2011). Analiz tekhnolohyi priamoho vosstanovleniya oksydov metallov s pryomenenyem pechei s vrashchaisuchymysia podom [Analysis of the technologies of direct reduction of metal oxides involving rotating-hearth furnace]. *Visnyk Natsionalnoho tekhnichnoho universytetu «Kyivskiy politekhnichnyi instytut». Seriya «Mashynobuduvannia» – Messenger of the National Technical University “Kyiv Polytechnic Institute». Series “Machine building”, 1*, 184-192. URL: <http://ela.kpi.ua/bitstream/123456789/4244/1/184.pdf> [in Russian].
17. Steel Statistical Yearbook 2018. (2018). *Worldsteel.org.* URL: https://www.worldsteel.org/en/dam/jcr:e5a8eda5-4b46-4892-856b-00908b5ab492/SSY_2018.pdf [in English].
18. Kyrychenko, I.S. & Aleksakhyn, A.V. (2016). Razvytye myrovoho y otechestvennoho proyzvodstva zheleza priamoho vosstanovleniya [Development of the world and national production of direct reduced iron]. *Molodoi uchënyi – Young scientist*, 2 (106), 85-90. URL: <https://moluch.ru/archive/106/25375/> [in Russian].
19. World Steel In Figures 2019. *Worldsteel.org.* URL: <https://www.worldsteel.org/en/dam/jcr:96d7a585-e6b2-4d63-b943-4cd9ab621a91/World%2520Steel%2520in%2520figures%25202019.pdf> [in English].
20. Sinivasaham, Hopal. (2019). Yak u Yehypti opanovuiut vyrobyntstvo hubchastoho zaliza. – [The way Egypt masters the production of sponge iron]. – *GMK.center*, 08, Feb. URL: <https://gmk.center/opinion/kak-v-egipte-osvaivajut-proizvodstvo-gubchatogo-zheleza/> [in Ukrainian].
21. Kuvaiev, S. (2010). Priamaia perspektyva [Direct perspective]. *Ukrudprom.ua*, 18, Feb. URL: http://www.ukrudprom.ua/analytics/Geleznaya_pryamota_Ukraini.html [in Russian].
22. Reznik, H. (2013). Zheleznaia tendentsiia [Iron tendency]. *Minprom.ua*, 19, Apr. URL: https://www.minprom.ua/articles/first_news121374.html [in Russian].
23. Ukraina pochno prekratila import horyachebriketirovannogo zheleza iz Rossii [Ukraine has almost stopped importing direct reduced iron from Russia]. (2018). *Ukrudprom.com*, 09, Jan. URL: http://www.ukrudprom.com/news/Ukraina_pochti_ostanovila_import_goryachebriketirovannogo_geleza.ht

ml [in Russian].

24. TsHOK nameren vyity na rynek okatyshei dlia tekhnolohyy DRI. – hendyktor [CGOK is going to enter the market of DRI-technology pellets]. (2017). *Uaprom.info*, 02, March. URL: <http://uaprom.info/news/157507-cgok-nameren-vyiti-rynek-okatyshej-tehnologii-dri-gendirektor.html> [in Russian].

25. Hendyktor TsHOKa Dmytryi Shevchik: «Povyshenye zh/d taryfov naneset ushcherb ymydzhу ukraynskoho byznesa v Evrope» [CGOK CEO Dmytryi Shevchik: “Increasing railway tariffs will damage Ukrainian business image in Europe”]. (2017). *Uaprom.info*, 02, March. URL: <http://uaprom.info/article/6205-gendirektor-cgoka-dmitrij-shevchik-povyshenie-zhd-tarifov-naneset-ushherb-imidzhu-ukraynskogo-biznesa-evrope.html> [in Russian].

26. «Metinvest Kholdynh»: «2018 hod prynez pozytyvnyi rezultat» [«Metinvest Holding”: “2018 has brought positive results”]. (2019). *Metal expert*, 22 January. URL: <https://metinvestholding.com/ru/media/pdf/207305> [in Russian].

27. SRO table 2019/2020 by region. (2019). *Worldsteel.org*, October. URL: <https://www.worldsteel.org/en/dam/jcr:c93c5979-982d-497b-b24f-ea7d5cb17eff/SRO%2520Press%2520Release%2520Table.pdf> [in English].

28. Worldsteel Short Range Outlook. (2019). *Worldsteel.org*, October. URL: <https://www.worldsteel.org/media-centre/press-releases/2019/worldsteel-short-range-outlook-2019.html> [in English].

29. The role of steel manufacturing in the global economy. (2019). *Oxford Economics*, May.. URL: <https://www.worldsteel.org/en/dam/jcr:fd44918-de3b-455b-9083-f770afa4a214/OE%2520Executive%2520Summary.pdf> [in English]

30. Top steelmakers in 2018. *Worldsteel.org*. URL: https://www.worldsteel.org/en/dam/jcr:80ce948e-6a12-47d0-baf1-26799888db67/2018%2520Top%2520Steel%2520Producers_Extended%2520List.pdf [in English].

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JEL F15, F23, L61, L72

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Ключові слова: експортний потенціал, інновації, залізо прямого відновлення, глобальний ринок, гірничо-металургійні підприємства.

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Olha Hrybinenko, PhD (Economics), Dean of Faculty of Finances and Economics. **Svitlana Shahoian**, PhD (International Economics), Associate Professor. Dnipro University of Technology. **Development of the Export Potential of Ukraine in the Context of Innovations of the International Mining and Metallurgical Companies.** The paper analyzes export portfolio of Ukraine involving evaluation of status of the products manufactured by mining-metallurgical companies. Structure and balance of the external trade of Ukraine with the emphasis on leading countries-partners and main export product groups are identified. Innovative product of mining and metallurgical companies, i.e. direct reduced iron favouring sustainable national development, are characterized. Technological features and economic factors of the expedient direct reduced iron production are determined. Conditions of the global direct reduced iron market are analyzed: geographical structure of production, export, and import. Ukrainian practice in the implementation of projects for direct reduced iron production on the basis of Ukrainian iron-ore raw material is studied. Demand of the Ukrainian metallurgical plants for direct reduced iron is considered. Factors favouring the product manufacturing in such system as “direct reduced iron – high-quality steel – high-technology products with high added value” are specified. Proposals concerning the intensifications of Ukrainian export potential are formulated.

Keywords: export potential, innovations, direct reduced iron, global market, mining and metallurgical enterprises.

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Грибиненко Ольга Николаевна, кандидат экономических наук, декан финансово-экономического факультета. **Шагоян Светлана Николаевна**, кандидат экономических наук, доцент. Национальный технический университет «Днепропетровская политехника». **Развитие экспортного потенциала Украины в контексте инноваций международных горно-металлургических компаний.** Определены способы развития экспортного потенциала Украины в контексте продуктовых инноваций международных горно-металлургических компаний. Исследование выполнено с учетом содержания модели инновационного и устойчивого развития страны. Информационная база исследования сформирована статистическими данными Государственной службы статистики Украины, публикациями Всемирной ассоциации производителей стали, научными публикациями по вопросам технологии прямого восстановления железа, другими профильными информационными материалами (интервью, новости, аналитика). Проанализирован экспортный профиль Украины, в том числе статус продукции горно-металлургических компаний. Определены структура и сальдо внешней торговли Украины, ведущие страны-партнеры и основные товарные группы в экспорте. Оценены рыночные перспективы железа прямого восстановления – инновационного продукта горно-металлургических компаний, который способствует устойчивому развитию. Определены технологические особенности и экономические факторы производства железа прямого восстановления. Проанализированы состояние глобального рынка железа прямого восстановления и украинский опыт внедрения проектов его производства на основе собственного железорудного сырья. Предложены меры по содействию расширению продуктового предложения предприятий в системе «железо прямого восстановления – сталь высокого качества – высокотехнологичная продукция с высокой добавленной стоимостью». Получил дальнейшее развитие подход к обоснованию стратегических задач развития экспортного потенциала горно-металлургической отрасли, который будет обеспечивать обновление экспортного профиля Украины.

Ключевые слова: экспортный потенциал, инновации, железо прямого восстановления, глобальный рынок, горно-металлургические предприятия.