

DETERMINANTS OF ENTERPRISES PROFITABILITY OF CHEMICAL INDUSTRY IN MODERN CONDITIONS OF ECONOMIC SECURITY ENSURING

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Abstract. The article provides a thorough analysis of the world's and Ukrainian's chemical industry. The volume of the chemical sales of the top 10 countries and the global chemical production by segments are determined. The comparative characteristics of the main indicators of the chemical industry of Ukraine and the other countries are presented. Based on the analysis of statistical information, impact factors influencing the resulting indicator (enterprises' net profit) of the Ukrainian chemical enterprises have been systematized. The correlation-regression analysis between impact factors and the resulting indicator of Ukrainian chemical enterprises is carried out.

Keywords: chemical industry, analyze, correlation, net profit, impact factors.

Introduction

The chemical industry is one of the key industries at the world level. It is the basis of economic development and growth in many countries, which creates innovative substances and materials. Besides, the chemical industry is the basis for many other industries, as well as agriculture. Today, the chemical industry is one of the most innovative and contributes to the solution of social problems, in particular, those that relate to climate change, health, and nutrition. So, we can state that the chemical industry can be one of the leading for countries' economic security formation and their innovative development.

In Landscape of the European Chemical Industry (2018) (Landscape of the European Chemical, 2018; Official website of European Commission) is shown that world chemical sales were €3,360 billion in 2016, up 0,4% from €3,347 billion in 2015. In 2015, the largest share of the market of the chemical products sale belonged to the Asian market – 61%. The second place was occupied by Europe, with a market share of 17.4%. It should be mentioned that in 2016 including non-EU countries, total European chemical sales reached €597 billion, or 17.8 percent of world output. Besides as it was shown at the European Commission official website the chemical industry generates 1.1 percent of EU gross domestic product.

According to Chemicals trends analyzer (2017), the third place was taken by North America, whose market share was 16.5%. Latin America owned 3.8% of the world chemical market, and 1.3% – the rest of the world.

In 2018 (2020 Facts & Figures, 2020) world chemical sales were the same as in 2015 – €3,347 billion. And grew by 2.5% from €3,266 billion in 2017. The world leader in 2018 was China with a turnover of €1,198 billion. With South Korea and Japan, China contributes almost 45 percent of global chemical sales in 2018. So, the Asian market has the largest share of the world market of the chemical products for a few years already and continues to gain it.

It is followed by the European market. In 2018 chemical sales of EU and the rest of Europe reached €694 billion, or 20.7 percent of world market share. And the 3rd place is still taken by North America with a market share of 15.8%.

Aim of the article is to analyze chemical industry in the world and in Ukraine and to measure the effectiveness of its main players.

1. Survey of the chemical industry in Ukraine and the world

The chemical industry plays an important role not only in the world economy but also in the economy of the world's leading countries. To understand it better, Figure 1 shows the top 10 chemical-producing countries in 2018.

As shown in Figure 2, the top 10 chemical-producing countries in 2018 had a combined turnover of €2,901 billion and took 86.7% of global chemical sales. And almost half of these sales were provided by China (41.3%).

China has demonstrated rapid growth in the last 10 years (from 18.2% of world chemical sales in 2008 to 35.8% in 2018). It means that now the chemical industry in China is one of the leading and is taken to

the next stage of development. China is about to take the leading place in the world chemical industry. By 2030 China is estimated to produce almost 50% of global chemical sales.

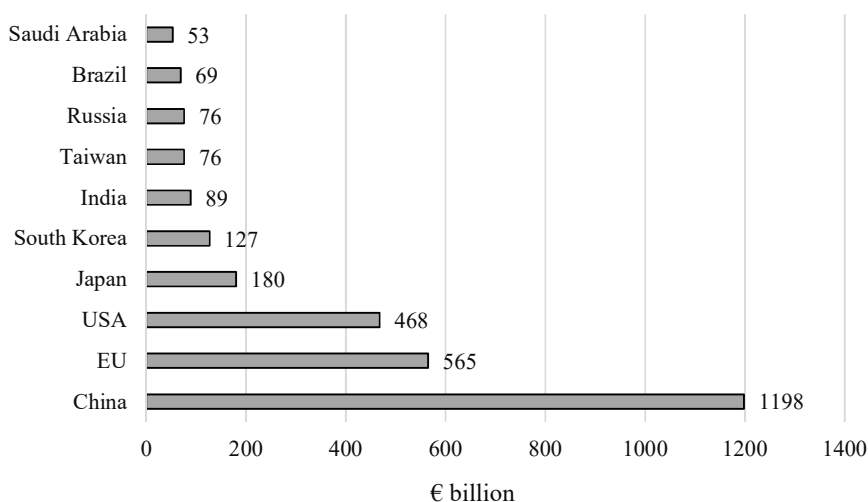


Figure 1. The volume of the chemical sales of top 10 countries in 2018

Source: compiled based on (2020 Facts & Figures, 2020)

Though the EU is in the 2nd place, there is a negative tendency: the world chemical sales dropped from 26.5% in 2008 to 16.9% in 2018. The main competitor for the EU now is China and the rest of Asia. Nevertheless, the chemical industry in the EU is highly innovative and competitive

The growth rates of the global chemical industry by segments (% change (y-o-y)) in 2015 and the outlook for 2020 are given in Fig. 2.

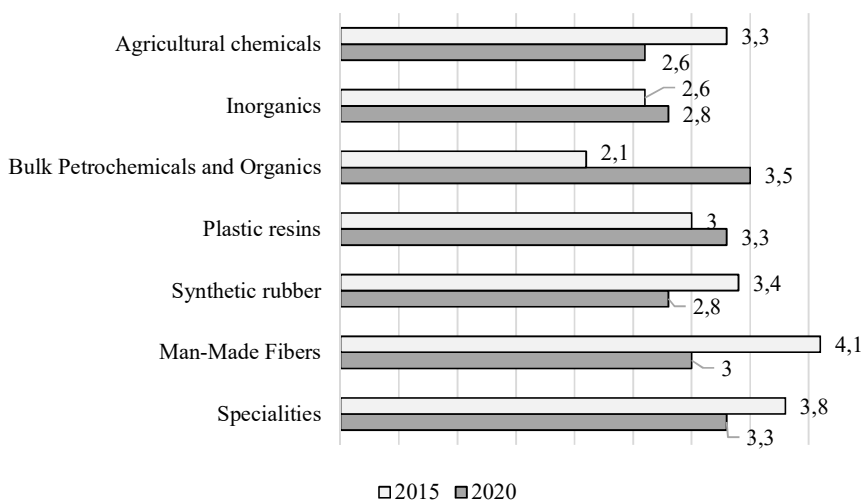


Figure 2. Global chemicals production outlook by segment (% change y-o-y)

Source: compiled based on (Chemicals trends analyzer, 2017)

According to the information provided above, we can assert that the role of the chemical industry continues to grow on a worldwide scale.

As for any innovative industry, for the chemical industry, the question of Research and Innovation (R&I) is crucial. To obtain good results it is necessary to provide R&I spending (Figure 3).

Global R&I spending in the chemical sector reached €42.9 billion in 2018, from €26.2 billion in 2008 (2020 Facts & Figures, 2020).

The leader in R&I spending is China. In 2018 China had 27.5% of all world R&I spending in the chemical industry. Taking into account Figure 4, it should be mentioned that there is a relationship between the growth of China's R&I spending and increasing its sales.

Chemical R&I spending in the EU is € 10 billion. So, the EU is the second-largest investor in the world (23.3% of global chemicals R&I spending in 2018). But despite the amount of R&I spending chemical sales are lower compared with China (2020 Facts & Figures, 2020).

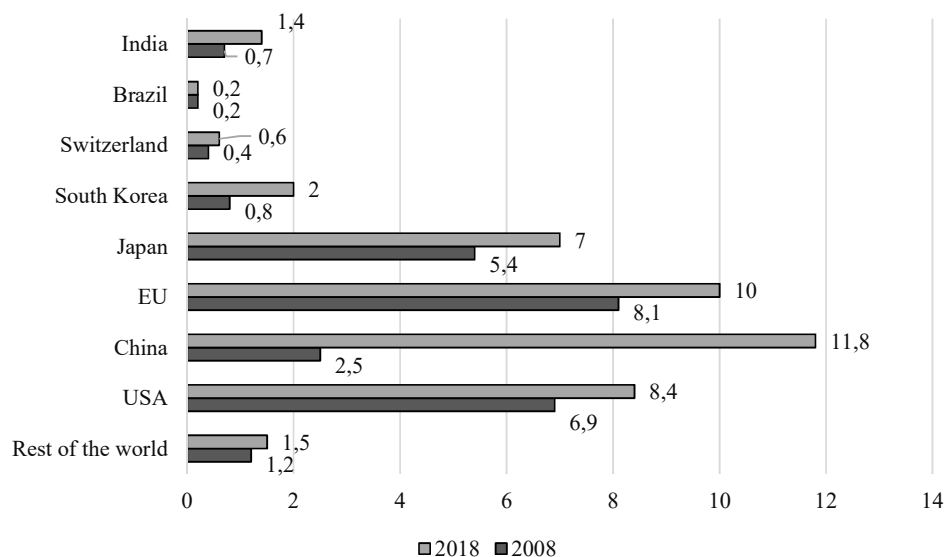


Figure 3. Chemicals R&I spending, € billion
Source: compiled based on (2020 Facts & Figures, 2020)

To match, in 2017 the biggest chemical R&D spending was made by China, Japan, South Korea, India (Asia), Germany, France, United Kingdom, Netherlands, Switzerland (EU) and the United States (The Global Chemical Industry, 2019).

Also, to understand better the global chemical market we define the import-export activity of leading countries.

Table 1. The import-export activity of EU and other major players in the international trade of chemicals, 2018, € billion

Country	Exports	Imports
EU-28	355,8	203,6
United States	188,5	223,8
China (excl. Hong Kong)*	125,1	171,5
Switzerland	90,4	45,2
Japan	67,0	65,2
South Korea	68,3	46,7
India	42,6	51,5
Singapore	49,3	25,3
Canada	31,9	42,0
Taiwan*	31,7	28,9
Mexico	12,8	41,4

Notes: “*” – data are given for 2017

Source: compiled based on (Production and international trade, 2019)

As we see from Table 1, the major international players in chemicals trade were presented mainly by European, Asian and American countries in 2018. The leader in export activity was the EU, the second place took the USA, and the third – China. In import activity, the first place belonged to the USA, the second – to the EU, and the third – to China. So, China was both the third-largest importer and exporter with values in 2018.

According to Table 1, in total, the EU and Switzerland performed 442.6 € billion of chemicals’ export. The number of chemicals exported by Asian countries (China, Japan, South Korea, India, Singapore, and Taiwan) was 384 € billion. And the export activity of the USA, Canada, and Mexico was equal to 232.9 € billion. So, the European market had leading positions in export activity.

But in import structure European market had the third position (248.2 € billion), after American (307,2 € billion) and Asian (389,1 € billion) markets.

In the case of Ukraine, the chemical industry is one of the six classical branches of the Ukrainian economy that are “basic” ones: extractive, metallurgical, chemical and petrochemical, food industry, power engineering, and machine building. Today, despite the growing importance of this industry on a worldwide scale and the local potential available, the Ukrainian chemical industry needs additional capital investments and further development.

Table 2 shows the main indicators of the chemical industry of Ukraine in comparison with the developed countries of the world.

Table 2. Indicators on the chemical industry of Ukraine and the developed countries of the world in 2018

Country	Indicator				
	Number of companies	Volume of sold industrial products, mln euro	Capital investment, mln euro	Average number of full-time employees, people	Costs of research and development, mln euro
Germany	2 050	203 000	7 800	462 553	11 800
United Kingdom	3 608	62 800	5 200	153 000	5 900
Finland	400	24 100	1 190*	33 700	478*
Belgium	> 720	65 000	2 100	92 500	4 500
Italy	2 800	56 000	1 700	109 600	559
Poland	> 11,000	62 150	-	315 000	700
Ukraine*	161	2 608	85 7	> 40 000	3 7

Notes: “-“ – no data available; “*” – data are given for 2017.

Source: compiled based on (Landscape of the European Chemical Industry, 2020; Scientific and Innovative Activity, 2019; Capital investment, 2019)

Thus, Ukraine lags behind the advanced countries of the world in terms of indicators of the chemical industry. In particular, in 2018 Ukraine had lower indicators of the volume of sold industrial products (for example, sales in Germany were 77.8 times higher, in Great Britain – 24.1 times higher, in Italy – 21.5, in Finland – 9.2 times). Moreover, the number of companies working in the chemical industry of Ukraine is much less than in other analyzed countries.

Therefore, to increase the volume of sold industrial chemical products, Ukraine must pay much more attention to creating new chemical companies and motivating existing by intensifying capital investment. Similarly, the government and enterprises must invest more in research and development activity.

To understand the situation in Ukraine, the dynamic of its export-import activity with chemicals for 5 years – from 2014 to 2018 is given in Figure 4.

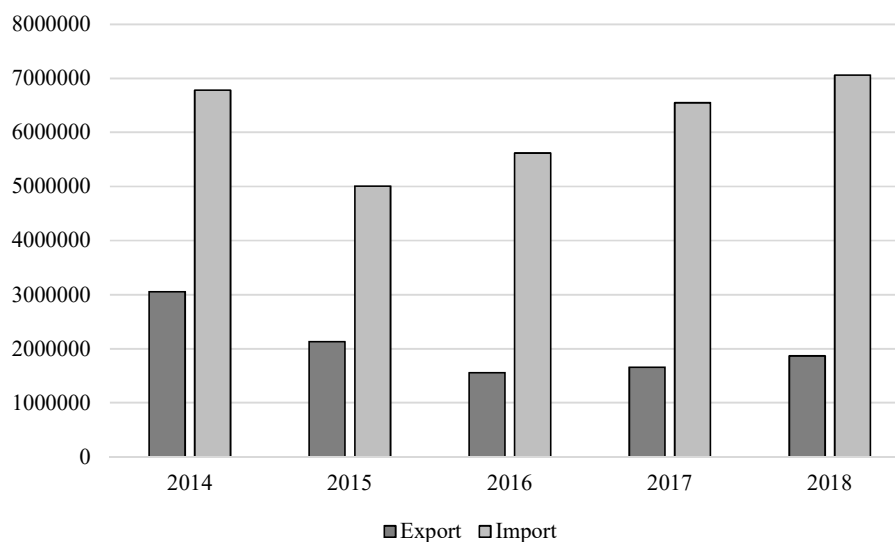


Figure 4. Export-import activity with chemicals of Ukraine during 2014-2018, \$ ths

Source: own calculations based on <http://www.ukrstat.gov.ua/>

As we can see, Ukraine's import activity is higher than its export activity. Besides Ukraine mainly imports high-tech products with high added value, for example, pharmaceuticals, photographic or cinematographic goods. And, also, such products as fertilizers and soaps, surfactants. Although Ukraine has the potential to produce some of these products on its own.

3. Analysis of impact factors influence on resulting indicator at chemical enterprises of Ukraine

Therefore, taking into account that the effectiveness of the industry depends on the effectiveness of its main players, we will evaluate the effectiveness of particular industrial enterprises. For analysis, we choose two big chemical enterprises of Ukraine – PJSC “Sumykhimprom” and PJSC “Azot”.

PJSC “Sumykhimprom” produces mineral fertilizers, coagulants and additives to cement, acid, titanium dioxide, and pigments and other types of chemical products.

PJSC “Azot” is one of the domestic producers of mineral fertilizers, producer of caprolactam and ion exchange resins.

It should be noted, the data used in calculations are inaccurate with the purpose to keep trade secrets. Firstly, as an indicator of the enterprises' effectiveness, we take net profit. The resulting indicators for PJSC “Sumykhimprom” and PJSC “Azot” for 5 years (from 2012 to 2016) are given in Table 3.

Table 3. Resulting indicators (net profit) for PJSC “Sumykhimprom” and PJSC “Azot” during the period 2012-2018, ths grn

Year	PJSC “Sumykhimprom”	PJSC “Azot”
2012	-209811	-1088083
2013	-200625	-2424729
2014	-99414	-8030515
2015	7619	-5727885
2016	2041	-2137435
2017	5642	-613533
2018	-25576	18965

Source: compiled based on of Public Joint-Stock Companies SUMYKHIMPROM and AZOT data

As we see from Table 3, as the result of the activity the enterprises in some periods received a loss, not profit. Accordingly, there is a need to determine factors affecting the profitability or loss rate.

So, on the next step, we determine factors that can impact the results of the enterprises' activity (obtaining net profit or loss).

These factors are following 1) working capital; 2) total production costs of market products; 3) sales volume of products; 4) labor costs management (wage); 5) enterprise's debt; 6) total value of the enterprise's assets; 7) market share controlled by the company and 8) non-manufacturing costs.

The meaning of the mentioned factors for PJSC “Sumykhimprom” and PJSC “Azot” during 2012-2016 are given in Table 4.

Table 4. Dynamics of impact factors in 2012-2018 for a research model construction

Impact factors	2012	2013	2014	2015	2016	2017	2018
1	2	3	4	5	6	7	8
PJSC “Sumykhimprom”							
working capital, ths grn	-1148258	-1388811	-1473982	-1483166	-1500564	-1636714	-1786997
total production costs of market products, ths grn	179103	166704	185770	196857	192200	1837260	1995310
sales volume of products, ths grn	2098387	1415555	1959807	2508632	1819411	2140886	2334515
labor costs management (wage), ths grn	179103	166704	185770	196857	192200	311818	431236
enterprise's debt, ths grn	2057714	1993862	2165217	2161699	1882152	2032658	2113171
total value of the enterprise's assets, ths grn	1568872	1304285	1376128	1380145	1096817	1179976	1275616

market share controlled by the company, %	40	43	60	72	79	79	77
non-manufacturing costs, ths grn	328845	262133	271509	468526	302483	341386	401843

Table 4 (continued)

1	2	3	4	5	6	7	8
PJSC “Azot”							
working capital, this grn	-2840462	-4059705	-11758987	-21040606	-23 765 922	-24014518	-20772085
total production costs of market products, this grn	6056978	5070024	5374350	5832845	7599474	3022308	2982665
sales volume of products, this grn	6159346	4405410	5718922	8285460	9041044	3908888	3861519
labor costs management (wage), this grn	365236	385322	182728	139988	227984	214883	402858
enterprise’s debt, this grn	4572361	7218202	13772206	24285947	26 793 418	28525369	25963884
total value of the enterprise’s assets, this grn	4755788	6030604	3646654	4811303	1069897	6141997	7056469
market share controlled by the company, %	39	39	32	35	36	38	38
non-manufacturing costs, this grn	1025002	1492444	7266233	6934612	3072468	1489097	1064080

Source: compiled based on of Public Joint-Stock Companies SUMYKHIMPROM and AZOT data

To verify the consistency of correlation between impact factors and resulting indicator correlation matrixes for PJSC “Sumykhimprom” and PJSC “Azot” have been built using MS Excel (Table 5 and Table 6 respectively).

Table 5. Matrix of pair correlation coefficients between impact factors and resulting indicator PJSC “Sumykhimprom”

	Y	X1	X2	X3	X4	X5	X6	X7	X8
Y	1								
X1	-0,74405	1							
X2	0,457337	-0,78198	1						
X3	0,563764	-0,33163	0,394941	1					
X4	0,468856	-0,82119	0,949813	0,477466	1				
X5	0,020167	-0,12451	0,115222	0,613595	0,194757	1			
X6	-0,66085	0,664116	-0,36754	0,214131	-0,30742	0,579813	1		
X7	0,981169	-0,82101	0,559574	0,491813	0,574503	-0,05342	-0,73566	1	
X8	0,55683	-0,34193	0,316526	0,888185	0,420427	0,469834	0,114582	0,46354	1

Source: authors’ calculations

As we see from Table 5, there is a strong correlation between the resulting indicator Y and impact factor X7 (0,981169). The value of this coefficient shows the direct connection of the level of the enterprise’s net profit market share controlled. The increase in mentioned factor causes increasing of the net profit and a reducing in mentioned factor causes reducing of the net profit. Rising market share enterprise involves more customers and that way can sell more products. So, influencing and controlling factor X7 it’s possible to achieve high results in net profit improvements.

Also, analysis has shown a strong correlation between the resulting indicator Y and impact factor X1 “working capital” (-0,74405). Nevertheless, there is an inverse relationship that is approved with the negative value of the pair correlation coefficient. So, to increase the enterprise’s net profit it is necessary to control its working capital and expand it.

Direct average correlation is between net profit and two impacting factors – X2 “total production costs of market products” (0,457337), X3 “sales volume of products” (0,563764), X4 “labor costs management (wage)” (0,468856) and X8 “non-manufacturing costs” (0,5415901). And inverse middle correlation is between net profit and such impacting factor as X6 “total value of the enterprise’s assets” (-0,66085).

And the factor X5 “enterprise’s debt” has no impact on the net profit.

According to Table 6, we see almost the same situation as for PJSC “Sumykhimprom”. There is a strong direct correlation between the Y “net profit” and impact factors X4 “labor costs management (wage)”

(0,6691345) and X7 “market share controlled by the enterprise” (0,89121). And these factors increasing is wishable as it will help to increase the net profit.

Table 6. Matrix of pair correlation coefficients between impact factors and resulting indicator PJSC “Azot”

	Y	X1	X2	X3	X4	X5	X6	X7	X8
Y	1								
X1	-0,10063	1							
X2	-0,367275	0,185104	1						
X3	-0,384718	-0,22677	0,881204	1					
X4	0,6691345	0,513424	-0,28418	-0,54806	1				
X5	0,1595467	-0,99549	-0,26047	0,149979	-0,44675	1			
X6	0,3759891	0,152473	-0,8726	-0,83064	0,484388	-0,07015	1		
X7	0,89121	0,249066	-0,29773	-0,42105	0,753925	-0,18626	0,504965	1	
X8	-0,951543	-0,16916	0,348501	0,508578	-0,80366	0,10743	-0,40463	-0,92652	1

Source: authors' calculations

Factors X1 “working capital” (-0,10063) and X5 “enterprise’s debt” (0,1595467) have almost zero impact on the net profit. They don’t have to be considered.

Inverse correlation is between net profit and X8 “non-manufacturing costs” (-0,951543). This factor must be decreased to improve net profit.

More three factors have a really low impact – X2 “total production costs of market products” (-0,367275), X3 “sales volume of products” (-0,384718), and X6 “total value of the enterprise’s assets” (0,3759891). But they shouldn’t be taken out of consideration.

As a result of the research, we can mention that to improve enterprises' efficiency it is advisable to pay more attention first of all for market share expanding.

Conclusions.

Thus, the chemical industry is one of the leading in the world scale. It helps not only to increase countries' innovative activity but also makes a huge impact on the countries' economic security formation.

The Asian chemical market has the largest share mostly thanks to China which is the world leader. The second place is taken by the European market, and the third – by North America.

Additionally, the chemical industry is the one that needs large R&I spending. The leader in R&I spending is China too. In 2018 its R&I spending took an almost third part of the world’s R&I spending.

Despite the crucial importance of the chemical industry for Ukraine, comparing with other countries Ukraine has much worse indicators: lower volume of sold industrial products; the lower number of companies working in the chemical industry; lower R&I spending.

The analysis of two big chemical enterprises of Ukraine – PJSC “Sumykhimprom” and PJSC “Azot” helped to highlight the impact factors influencing the resulting indicator – the volume of the net profit. As impact factors were chosen the following 1) working capital; 2) total production costs of market products; 3) sales volume of products; 4) labor costs management (wage); 5) enterprise’s debt; 6) the total value of the enterprise’s assets; 7) market share controlled by the company and 8) non-manufacturing costs. For this purpose, the correlation-regression analysis was conducted. It showed that the most influencing factor is market share.

Further researches will deal with the formation of action plan for market share expanding.

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