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Kseniya Skorik¹

STRUCTURAL TRANSFORMATIONS OF THE EU INDUSTRIAL SECTOR

The issue of industrial policy and industrial problems is one of the most controversial in the European academic community. Even today, we see a lack of theoretical basis for decision-making on industrial policy issues. The main purpose of the publication is to assess the contribution of industry to the socio-economic development of the EU and its member states, as well as to the dynamic structural changes that took place during 2000-2019.

To achieve the article's goal, the author uses such indicators as the share of the industrial sector in the generation of gross value added, employment, labor productivity, and exports/imports. The article reveals a general trend to increase in the share of the services sector in the generation of gross value added for the EU-28 and to decrease in the share of the industrial sector. It is established that industry remains an important sector for the EU economy, and for the EU-28, it provides almost 20% of gross value added and more than 70% of total exports, and accounts for about 15% of the employed population. For each of the EU countries, the socio-economic contribution of industry is different - for Central and Eastern Europe, it is more important in the generation of gross value added and employment than for the EU founder countries of the euro area (the EU-15 group). It is found that labor productivity in the EU-15 is higher than in other countries. Growing labor productivity is typical for Denmark, the Netherlands, Ireland, Sweden, and Great Britain, while lower productivity - for such CEE countries as Bulgaria, Romania, Lithuania, and Latvia. At the same time, growth rates of all industrial indicators in the latter countries is much higher than in the EU-15.

The author considers the new EU industrial policy and various problems of the industrial sector in the EU. The study was carried out on the statistical basis of the European Commission using the methodology of Polish scientists of the Warsaw School of Economics to study the new industrial policy (Krzysztof Falkowski, Adam A. Ambroziak 2015).

Keywords: *industry, sectoral structure of the industry, gross value added in industry, employment, exports, imports, value added in production, labor productivity, EU*

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Formulation of the problem. Industry in the EU is exposed to many serious problems arising due to changes in the international environment, as well as due to different potentials and discrepancies as to the political goals of individual EU member states. Global trends show a decline in the share of industry in world GDP due to increased tertiary sector. Over the recent twenty years, the share of industry in the world has decreased by almost 5%, which is a consequence of a long-term trend. The share of industry in the "old" industrialized countries, in particular those of the European Union, is declining the fastest [1, p. 45].

The relative contribution of industry to the EU economy is declining. Over the recent 40 years, the European economy has lost a third of its industrial base. The process of "deindustrialization" is also observed in other developed economies and is partly due to the growing production in other parts of the world [2, p. 2]. The internationalization of production and increase in the share of GDP generated by value added exports is observed worldwide [3, p. 16–21].

The purpose of this article is to investigate the importance of the industrial sector for the economy of the European Union and for each member state in particular; and to analyze structural changes in European industry in general and in the member countries using the indicators of gross value added, employment, labor productivity, exports and imports.

Presenting the main material. Among foreign researchers, the issues of European industrial policy and ways of its implementation have been studied by Ha Jun Chan (1986, 1994, 2010), Dani Rodrik (2008, 2014), Lin Ifu (2013), and Joseph Stiglitz (2013). Examining the experience of the United States and Europe, Mariana Mazzucato (2010, 2013) emphasized the need for a broad role of "transformational" public action in innovation and industrial change. Assessments and arguments about Europe were also presented by Benjamin Coriat (2004), Patricio Bianchi, Sandrine Labori (2006, 2011), Carl Eiger (2014), Franco Mosconi (2015) and scholars of the Warsaw School of Economics, including Adam Ambroziak (2017) [4]. .

Analysis of industrial policy in the EU is done in Bruegel, BusinessEurope, Industry for Europe, Institute for European Studies, Manufacture, Orgalim, MERCI, PIIE (Peterson Institute for International Economics), WIFO (Austrian Institute for International Studies), WIIW (Vienna Institute for International Economic Studies, in various analytical centers operating within clusters, etc.

The concept of a new industrial policy of the European Union. The new EU approach to industrial policy is characterized by a focus on environmental and digital change, and on limiting the negative impact on the climate (Table 1). Important recent documents include the New Industrial Strategy for Europe, proposals for reforms by European Commission President Ursula von der Leyen, the European Parliament's strategy and the Council of Europe's Strategic Program 2019-2024, the European Green Deal and the latest EU strategy of digital future (*Strategy on Shaping Europe's Digital Future*). According to the documents, the basis of industrial policy (within the horizontal approach) is based on technological and innovation policies and investment. In the coming decades, the industry expects changes in terms of the emergence of new products, new markets and business models, and transition to a circular economy.

Problems of the industrial sector in the European Union. Europe is a world leader in many industries, especially where high added value, new products and services with low environmental pollution are generated (for example, in the automotive, pharmaceutical and fashion industries). European companies use important technological achievements, such as nanotechnology, biotechnology, micro- and microelectronics, photonics, modern materials, etc. [6, p. 2].

Table 1

The concept of a new industrial policy of the European Union in recent documents

Development strategy (priority measures)	Elements of the Europe-wide policy
1) climate policy; 2) building a circular economy	<p>A common European energy data space to support innovation in the energy sector</p> <p>Launch of a transition platform based on regions and sectors with high carbon production</p> <p>EU strategy for clean steel and chemical industries</p> <p>New regulatory measures for the European energy network</p> <p>EU strategy for renewable energy offshoring</p> <p>Adjustment of the carbon border mechanism in accordance with the requirements of the World Trade Organization</p> <p>Building a circular economy - an action plan with due consideration of available products and technologies</p> <p>New regulations for the new battery market</p> <p>EU strategy for the textile market</p> <p>European Alliance for Pure Hydrogen, alliances for low-carbon industry and raw materials</p>
3) policy for domestic market and competition	<p>Action plan for the implementation of single market programs, the formation of a working group of member countries and Commission</p> <p>Strategy for small and medium business</p> <p>Revision and adaptation of competition rules until 2021, state aid rules</p> <p>Intellectual property action plan</p> <p>European Data and Information Strategy, common data space in individual sectors, Digital Services Act</p>
4) innovation and technology policy as a key element	<p>Public-private partnership within the European program "Horizon"</p> <p>A plan for the future European research and innovation area</p>
5) science and education policy	<p>European Skills and Qualifications Program, including recommendations for training and coaching</p> <p>Shaping a strategy for the European educational space</p> <p>Digital Technology Education Action Plan</p>
6) funding programs	<p>Forming a long-term budget - the European Council and Parliament</p> <p>The European Cluster Platform is an important project of common European interest, including battery and microelectronics initiatives. Revision of state aid rules, including projects related to energy transition</p> <p>Updating the financial strategy for sustainable development</p> <p>A new financial strategy for digital technologies</p> <p>Capital Markets Union Action Plan</p>

Source: compiled by author based on [5].

EU competitive resource in terms of industrial sector development:

- domestic market of 500 million consumers;
- highly skilled workforce;
- developed infrastructure and a network of research institutes;
- significant (although tending to decrease) share in the global value added [7, p.10–14];
- major competitive advantages in the chemical industry, machinery, transport equipment, food processing (according to the Harvard University analysis) [3, p. 10–14];

- high labor and social standards for the environment; large innovation capacity, leadership in the patents for "green" technologies;
- products and services with high added value.

Problems of the European Union in terms of industrial sector development:

- lag behind the United States and Japan in innovation and technological specialization (according to the EESC analysis) [8, p. 7–10];
- reducing competitiveness in some industrial sectors (in 10 sectors out of 23, including furniture, wood products, non-metallic mineral products, food and electronic equipment) [9, p. 82], due to increasing global competition [10, p. 4-9];
- gaps in electronics, which is a key competitive area (EU countries have lost a leading position in this sector due to the significant development of electronics in Southeast Asia) [3, p. 10–14];
- demographic problems - population aging after the 1960s and an increase in the average age for the EU-15 from 26 to 35 years (further forecast is not optimistic) [11, p. 7];
- decline in EU output over the recent decade.

There are significant asymmetries in the level of innovative development within the EU as an integration group. The lag behind the US and Japan in GDP science intensity is dangerous for the EU, while the level of science intensity of the EU business sector is also lower. The United States, Japan, and South Korea are ahead of the EU by composite innovation indicator (Maastricht Institute for Socio-Economic Research MERIT). The EU lags far behind other countries by private companies' expenditure on R&D, patent activity, public-private cooperation, and by the provision with skilled labor. Analysis of the relative level of innovation shows that the EU lags behind Canada, the United States, North Korea and Japan. The level of innovation of the BRICS countries does not exceed the EU's, but the innovation of China's economy tends to grow. The EU has a lower level of GDP science intensity compared to the leading technology countries, which is due to its underfunding by the private sector. Knowledge intensity of the leading EU companies is lower than in the USA and is inferior to global average [12, p. 195–204].

Regional dimension. Traditionally, European industry is concentrated around the "blue banana" - a corridor that stretches from northwest England to northern Italy through the Benelux countries, western Germany and eastern France. After the enlargement of the EU in the eastern direction, a large share of production was transferred to the eastern regions, which grew faster than the EU-15 [13, p. 48–53].

Changes in the industry structure of the European Union. The analysis used statistical classification of economic activities in the European community NACE (Rev. 2 (2008)). According to it, the industry includes such industries as extraction and processing of minerals (B), manufacturing (C), electricity, gas, heat supply and air conditioning (D) water supply; waste management and reconstruction (E).

Reorientation of the structure towards services. Traditionally, services have played an important role in the structure of EU output. In recent years, the share of services in total gross value added was in the range of 73-80% and, importantly, their significance for industry is growing. In 2003, services accounted for 71.7% of total output, in 2019 - 73.5%. Important service sectors include trade, transport, housing and catering (G – I), public administration, defense, education, health, and the public sector (O – Q).

The EU industrial sector accounted for a smaller share of the economy. The share of industry (B – E) in total output ranged from 20.4 to 18.7% in 2010 and 2019, i.e. decreased (Fig. 1). Given that in 2000 this figure was 22.24%, the decline in 2019 reached 3.54%.

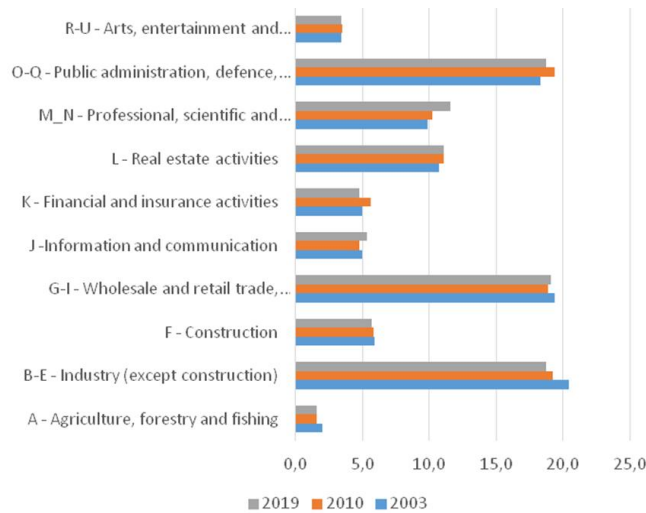


Fig. 1. Industry breakdowns in gross value added of the EU-28 in 2003, 2010 and 2019, % of total GVA

Source: author's own calculations, Eurostat data (nama_10_a10).

The Commission's analytical reports point to factors that reduced the role of industry and raised the importance of services in the EU-28 economy. The first factor is the higher elasticity of demand for some services (for example, education, health, leisure and personal services, etc.), as opposed to industrial goods. The second one is that the services were used by manufacturing / industrial companies at an intermediate stage. The third one is that productivity grew faster in production than in services, where prices grew more slowly. This was influenced by the partial transfer of production outside the EU, which in turn reduced production output and caused a redistribution of resources in favor of the services [14, p. 41].

Industry structure by countries and sectors. In the economies that joined the EU after 2000, industry remains a large sector (Fig. 2), but its average share in these countries decreased by 1.6%. The countries that joined in the 1970s and 1980s (UK, Portugal, Spain and Greece) are the other pole where industry is a smaller sector in terms of gross value added.

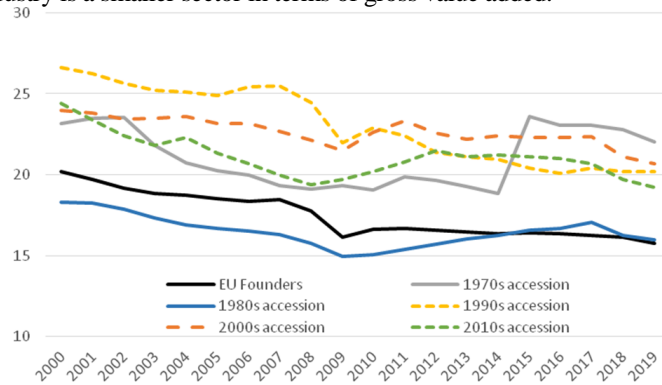


Fig. 2. Change in the share of industry in gross value added of EU-28 since 2000, for groups of countries in accordance with their accession to EEC / EU², % of total GVA

Source: author's own calculations, Eurostat data (nama_10_a10).

² The EU founding countries: Belgium, Germany, France, Italy, Luxembourg, the Netherlands, Denmark, Ireland, and the United Kingdom joined in the 1970s; in the 1980s - Greece, Spain, Portugal; in the 1990s - Austria, Finland, Sweden; in 2000 - Bulgaria, the Czechia, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovenia, Slovakia; after 2010 - Croatia.

It should be noted that for all groups of countries (divided by the time of their accession to the EEC / EU), except for those that joined in 2000 (less Croatia) and for Ireland from the group of member states that joined in the 1970s, since 2000 to this day, the share of industry has decreased. The largest change is observed in the group that joined in the 1990s - a 6% decrease, in the founding countries - a 4% reduction, and in Croatia - a 4% reduction too. The countries that joined in the 80s and 70s showed a tendency to recover (until 2017), except for the United Kingdom and Denmark, where the share of industry output has reduced by 4-5% since the turn of the century.

It can be seen that in 2019 the share of industry (Fig. 3) in the generation of gross value added was the largest in Ireland (34.9%), the Czechia (29.2%), Slovenia (26.7%), Poland (25.1%), Slovakia (24.5%), Germany (24.2%), Romania (24.1%), and Hungary (24.1%). The smallest share is in France (13.5%), Great Britain (13.3%), Malta (9.8%), Cyprus (8.0%), and Luxembourg (6.5%). The importance of industry in creating value added is higher in the new EU member countries of Central and Eastern Europe than in the EU-15. The largest increases in the share of industry from 2010 to 2017 were recorded in Ireland (12.2%), Bulgaria (3.9%), Greece (3.4%), and Portugal (1.6%). The largest declines from 2010 to 2019 were observed in Malta (14.2%), Finland (9.5%), Sweden (7.5%), Belgium (6.7%), Luxembourg (6.1%), and Great Britain (5.9%).

As to the geographical distribution of total EU-28 industry by individual member states, the leader is Germany with a 27.3% share in total gross added value (a 1.4% increase since 2000) (Fig. 4). The second largest is Italy (11.4%), followed by Great Britain (10.9%) and France (10.6%): their shares since 2000 have decreased significantly: by 5%, 1.6 and 2.3% respectively. The other EU-28 countries with the largest shares are Spain, Poland, Ireland, the Netherlands, Sweden, and Austria.

In 2019, these ten countries together accounted for 84.5% of total gross value added in the EU-28. Their share has decreased by 3.3% since 2000, which is partly due to the economic crisis of 2009 and the transfer of production processes to other EU countries with cheaper production or outside the EU. Such a trend is observed in Germany and France [14, p. 44]. EU industry by structure (categories B, C, D, and E) is shown in Fig. 5 and fig. 6.

The largest industrial sector by value added generation is manufacturing (C), with an average share of 83%. From 2011 to 2017, the value of the extractive industry halved to 2%. Another important industrial sector is the supply of electricity, gas, heat and air conditioning (D), whose average value in 2011–2017 was 10%. The importance of the extractive industries and water supply, waste management and recovery work in terms of added value has never increased.

The structure of value added in manufacturing during the analyzed years (Table 2) remains relatively unchanged. The largest sectors of EU industry include:

- production of metals and finished products less machinery and equipment (C24-C25), with a 12.6% share in total EU output in 2017;
- production of food, beverages and tobacco products (C10-C12), whose share in 2017 amounted to 12.5%;
- production of cars and other transport equipment (C29 – C30) in 2017 - 14.4% and production of machinery and equipment (C28) - 11.1%.

Other major sectors for the EU include: manufacture of computer, electronic and optical products (C26 – C27) - 8.6%; and production of chemicals and chemical products (C20) - about 7% in 2017

In 2011–2017, these sectors averaged 67.6% of gross value added, i.e. more than two-thirds of total EU output.

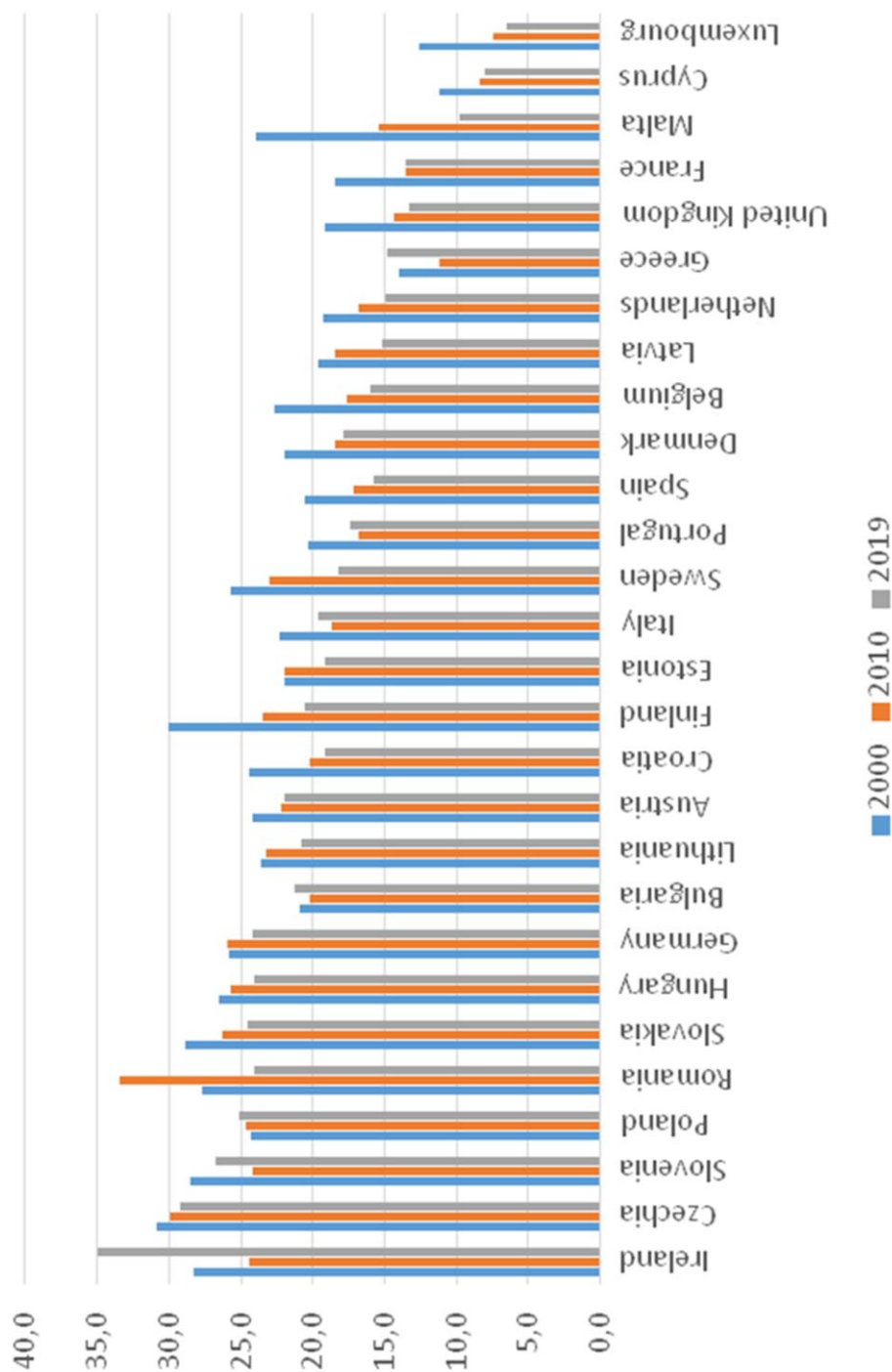


Fig. 3. Share of industry in gross value added of EU member countries in 2000, 2010, 2019, %
 Source: author's own calculations, Eurostat data (nama_10_a10).

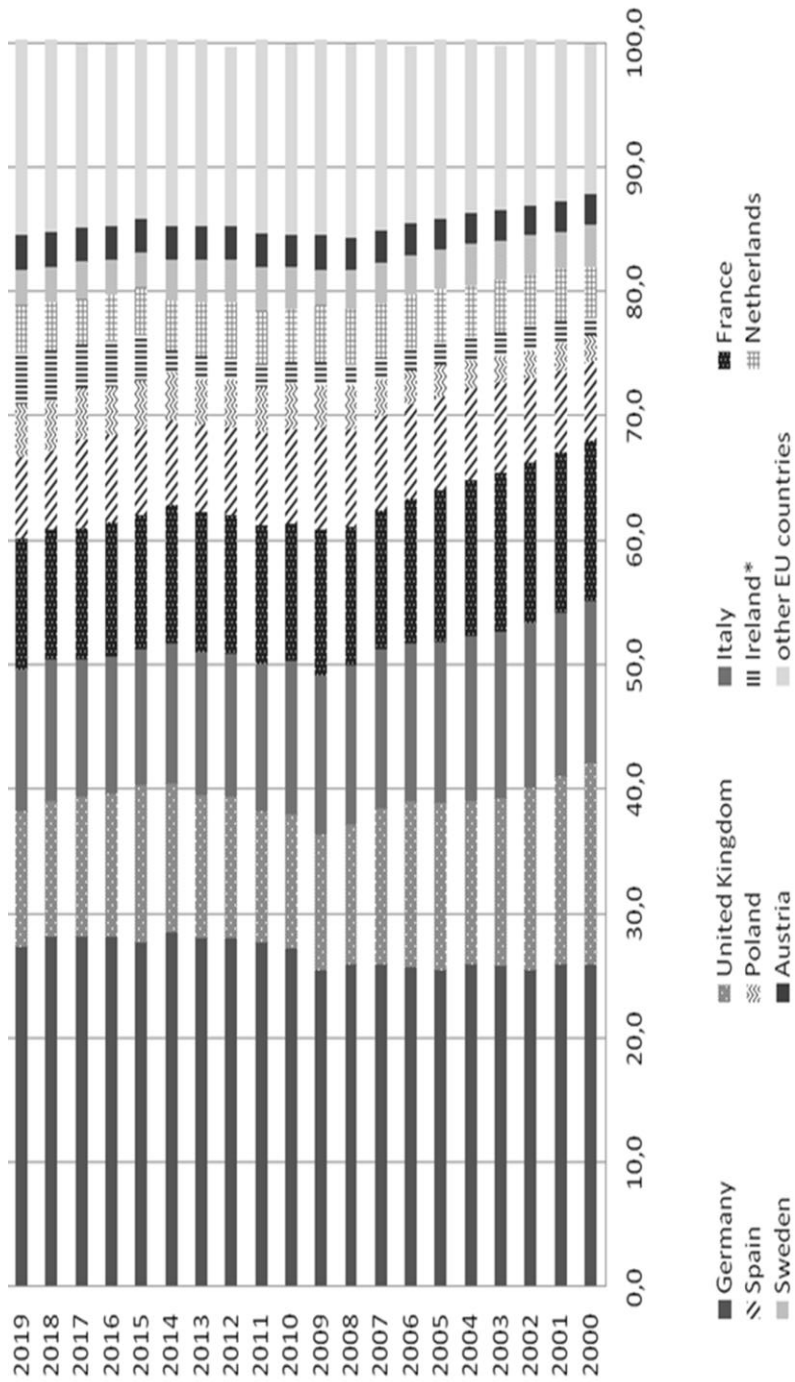


Fig. 4. % Shares of 10 top countries in gross industrial value added in EU-28 total for 2000-2019, %

Source: author's own calculations, Eurostat data nama_10_a10).

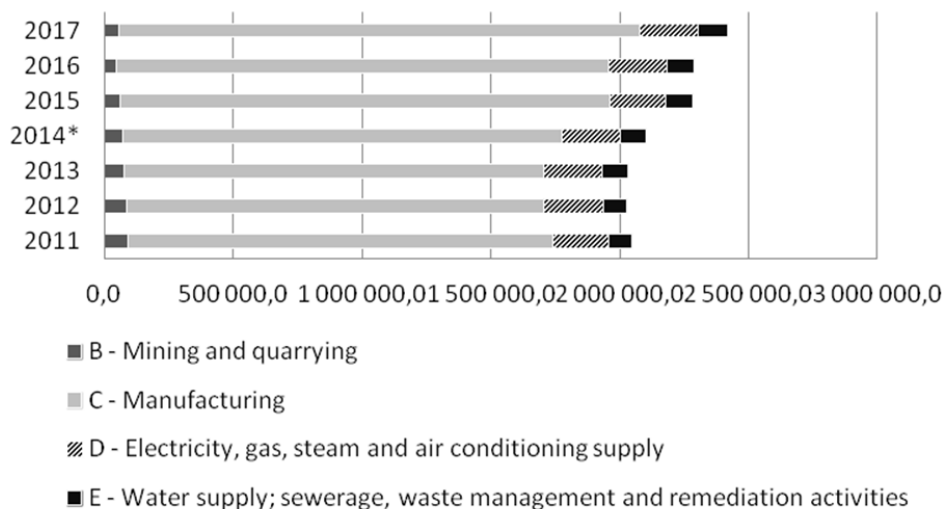
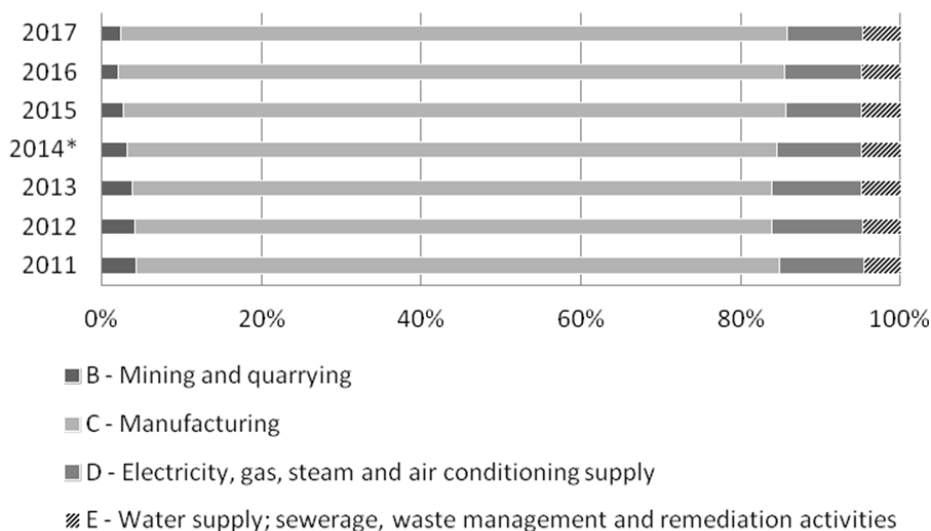


Fig. 5. Structure of industrial gross value added in EU-28 for 2011–2017, million euros
 Source: author's own calculations, Eurostat data (sbs_na_sca_r2).



* 2014 – average value for 2013 and 2015 in B and D.

Fig. 6. Structure of industrial gross value added in EU-28 for 2011–2017, %
 Source: author's own calculations, Eurostat data (sbs_na_sca_r2).

At the level of individual EU member states (Fig. 7), the item "manufacturing" (C) has a large share in the generation of gross value added in most countries. Ireland, Czechia and Slovenia in 2019 had the shares of 34.9%, 29.2 and 26.7%, respectively, while the shares of Malta (9.8%), Cyprus (8%), and Luxembourg (6.5%) were smaller.

As to the change in the share of manufacturing output, during 2000–2019 growth was only recorded in Ireland (10.5%), Greece (3.6%), Italy (1%) and eastern countries - Slovenia (2.5%), Poland (0.4%), and Bulgaria (1.1%). In other countries, there was a decline in the manufacturing sector: in Romania - by 9.3%, Malta - by 5.9%, Finland - by 3%, and Sweden - by 4.8%. If we analyze the period of post-crisis recovery in 2010-2019, we can see that a growth by more than 3% was only observed in Ireland (6.6%).



Table 2

Structure of gross value added in manufacturing in EU-28 for 2011– 2017

Aggregates of activities (NACE Rev. 2)	2011	2012	2013	2014	2015	2016	2017
Manufacture of food products	10,2%	10,5%	10,7%	10,6%	10,2%	10,1%	9,9%
Manufacture of beverages	2,3%	2,3%	2,3%	2,2%	2,2%	2,2%	2,3%
Manufacture of tobacco products	0,4%	0,5%	0,4%	0,4%	0,4%	0,4%	0,3%
Manufacture of textiles	1,3%	1,3%	1,3%	1,3%	1,2%	1,2%	1,2%
Manufacture of wearing apparel	1,3%	1,2%	1,2%	1,2%	1,0%	1,0%	1,0%
Manufacture of leather and related products	0,8%	0,8%	0,8%	0,8%	0,8%	0,8%	0,7%
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1,9%	1,8%	1,8%	1,8%	1,8%	1,8%	1,7%
Manufacture of paper and paper products	2,6%	2,6%	2,5%	2,5%	2,5%	2,4%	2,4%
Printing and reproduction of recorded media	2,1%	2,0%	1,8%	1,8%	1,7%	1,6%	1,5%
Manufacture of coke and refined petroleum products	1,2%	1,3%	0,8%	0,4%	1,4%	1,6%	1,7%
*Manufacture of chemicals and chemical products	6,7%	6,8%	6,7%	6,7%	6,2%	6,8%	6,9%
Manufacture of basic pharmaceutical products and pharmaceutical preparations	5,2%	5,2%	4,9%	4,9%	4,9%	5,0%	5,1%
Manufacture of rubber and plastic products	5,0%	4,9%	5,0%	5,2%	4,9%	4,9%	5,0%
Manufacture of other non-metallic mineral products	4,0%	3,7%	3,6%	3,6%	3,5%	3,5%	3,5%
Manufacture of basic metals	3,9%	3,7%	3,5%	3,6%	3,4%	3,3%	3,5%
Manufacture of fabricated metal products, except machinery and equipment	9,6%	9,8%	9,8%	9,8%	9,3%	9,3%	9,1%
*Manufacture of computer, electronic and optical products	4,7%	4,6%	4,6%	4,6%	4,2%	4,1%	3,9%
Manufacture of electrical equipment	5,2%	5,3%	5,2%	5,1%	4,7%	4,7%	4,8%
Manufacture of machinery and equipment n.e.c.	11,6%	11,8%	11,7%	11,7%	10,9%	10,8%	11,1%
Manufacture of motor vehicles, trailers and semi-trailers	9,4%	9,3%	9,7%	10,6%	10,8%	11,0%	10,8%
Manufacture of other transport equipment	2,9%	3,2%	3,3%	3,2%	3,2%	3,4%	3,6%
*Manufacture of furniture	1,8%	1,8%	1,7%	1,7%	1,6%	1,7%	1,7%
Other manufacturing	2,6%	2,6%	2,6%	2,5%	2,5%	2,5%	2,6%
*Repair and installation of machinery and equipment	3,4%	3,7%	3,7%	3,7%	3,4%	3,2%	3,1%

If we analyze the structure of value added in the EU manufacturing, we can see a clear country specialization (Table 3). The vast majority of countries have a high share of food processing, except for Germany, Sweden, Slovakia and Slovenia. The average share of this sector in the EU reaches 12%. Germany, France, Spain, the Netherlands, Ireland and Finland have a high share of chemical industry (9–15%). In Belgium, this figure in 2017 reached 16.4%. A high share of the production of plastic and rubber products is recorded in Slovakia (10.4%), the Czechia (9.2%), Romania (8.3%), Slovenia (8%), and Hungary (7.6%).

Most countries show a high share in the sector of metal products (except machinery), only in Lithuania, Greece, Romania, Hungary, Ireland, Denmark, Belgium the figure is less than 9%. Also important for the EU is the machinery and equipment sector with an average share of 12.7%. And in some specialized countries - Germany, Sweden, Czechia, Hungary, and Romania - this figure reaches 14–22%. The indicator for Slovakia is 25.3%.

The indicators of the pharmaceutical industry in 2017 were the following: in Ireland - 34.6%, Denmark - 24.8%, Belgium - 15%, Slovenia - 10.5%, and Cyprus - 11%, respectively. The sectors of computer, electronic, optical products and electrical equipment in the specialized countries in 2017 were as follows: in Germany - 15%, Slovenia - 14.3%, Austria - 14.4%, Hungary - 14.1%, Finland - 13.4%, Slovakia - 13.2%, Czechia - 12.6%, Estonia - 12.3%, Denmark - 10.8%, the Netherlands - 10.2%, France - 9 %, and Great Britain - 8.7%.

The largest shares in the production of mineral non-metallic products are recorded in Luxembourg - 20.8%, Malta - 12.4%, Cyprus - 11%, Latvia - 7.6%, Croatia - 6.9%, and Bulgaria - 6.3%; in the production of coke and petroleum products - Greece - 16.4%; in the production of basic metals - Austria - 8.3%, Slovakia - 8.8%, Bulgaria - 8%, Sweden - 7.1%, Finland - 7.5%, and Belgium - 6.3%; in furniture production - Lithuania - 11.5%, and Malta - 7.1%; in the production of other wood products - Latvia -26%, Estonia -18.4%, and Lithuania -7.3%; in paper production - Finland - 15.2%, and Sweden - 8.3%; and in clothing production - Bulgaria - 7.9%, Portugal - 6.1%, and Romania - 5.9%.

The main factors include low corporate taxation, which led to the attractiveness of the high-tech sector (R. Foster, 1994), a business-oriented regulatory policy, skilled labor, a focus on long-term industrial policy (since 1950), attraction of foreign direct investment, and proper financing for research and innovation. It is also important to note that Ireland is the only EU country where the growth of the trade balance due to technology since 2000 has reached 1000% [14, p. 200].

By absolute values of gross value added in 2019, among the EU member states (Fig. 8), the undisputed leader is Germany, followed by Italy, France, Great Britain and Spain. These are the countries with the largest economies within the European Union. The largest increase since 2010 was recorded in Germany - by 152,756 million euros and, despite the crisis - by 76,457 million euros from 2000 to 2010.

From the data of Fig. 9 it can be seen that during the period between 2004 and 2019 the growth of value added in industry and manufacturing was the highest in Central and Eastern Europe: Ireland - 224.7% (industry) and 224.5% (manufacturing), Romania - 216.3 and 195.5%, respectively, Bulgaria - 184.2 and 224.8%, Poland - 151 and 161.8%, and Estonia - 149.7 and 148.4 %. The largest decline in manufacturing was shown by Finland - (-3.5) %.

The importance of industry for the EU economy is also demonstrated by the structure of EU imports. According to data of Fig. 10, the share of imports of industrial goods of the EU countries in total exports of the EU-28 during 2018 was 74.3%, while that of non-industrial goods (other NACE sections) - 25.7%. The structure of EU exports was almost opposite: industrial goods accounted for 47.2% of total imports and for 52.8% of those of non-industrial goods – (Fig. 11).

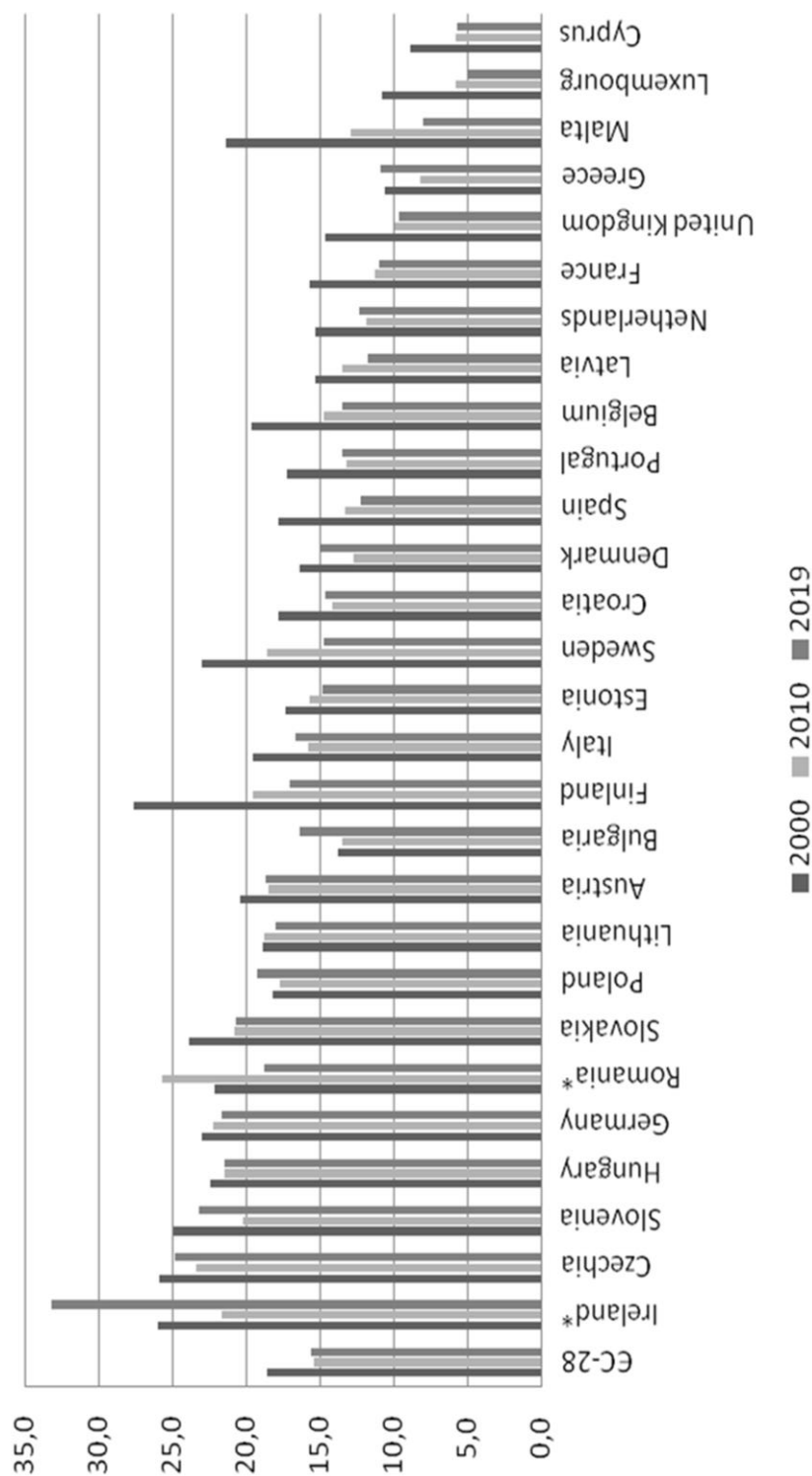
Table 3

Structure of gross value added in manufacturing, EU-28 in 2017, %

	EU-28	Germany	France	Italy	United Kingdom	Spain	Poland	Netherlands	Belgium	Austria	Sweden	Czechia	Denmark	Finland	Hungary	Pengual	Romania*	Slovakia	Ireland*	Creece	Slovenia	Bulgaria	Croatia	Lithuania	Estonia	Larvia	Luxembourg	Cyprus	Malta
Manufacture of food products	12.0%	7.5%	15.5%	10.8%	14.4%	15.7%	14.5%	18.1%	12.9%	9.1%	7.4%	5.9%	13.6%	8.8%	8.7%	11.6%	7.5%	19.1%	24.8%	5.9%	12.3%	18.2%	17.6%	11.6%	14.3%	23.6%	32.6%	0.0%	
Manufacture of beverages	2.6%	1.2%	5.4%	2.1%	3.6%	4.1%	2.6%	2.4%	3.1%	3.6%	1.5%	2.4%	1.2%	1.3%	1.8%	4.2%	4.2%	1.4%	3.1%	4.0%	1.1%	3.6%	5.9%	2.7%	2.2%	3.0%	4.9%	4.1%	14.8%
Manufacture of tobacco products	0.4%	0.4%	0.2%	0.1%	1.3%	0.3%	1.6%	0.4%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.2%	1.8%	0.6%	0.0%	0.0%	4.1%	0.0%	0.2%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Manufacture of textiles	1.3%	0.9%	0.9%	2.9%	1.7%	1.6%	1.3%	1.3%	2.0%	1.0%	0.7%	1.6%	0.9%	0.6%	0.7%	5.1%	2.3%	1.0%	1.8%	1.6%	1.9%	1.1%	3.3%	3.3%	1.6%	0.0%	0.9%	0.0%	
Manufacture of wearing apparel	1.3%	0.5%	0.8%	4.1%	0.6%	1.1%	1.2%	0.3%	0.4%	0.4%	0.2%	0.8%	0.6%	0.8%	0.6%	6.1%	5.9%	1.2%	0.1%	1.8%	0.7%	7.9%	3.1%	4.5%	2.6%	3.0%	0.0%	0.5%	1.4%
Manufacture of leather and related products	0.9%	0.2%	1.0%	3.7%	0.2%	1.1%	0.5%	0.2%	0.0%	0.3%	0.1%	0.2%	0.0%	0.3%	0.0%	4.1%	2.5%	1.4%	0.1%	0.4%	1.0%	1.1%	1.8%	0.2%	0.5%	0.1%	0.0%	0.1%	0.0%
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and palatine materials	2.1%	1.4%	1.5%	1.8%	2.1%	1.8%	3.1%	1.6%	1.6%	4.9%	4.8%	2.6%	1.9%	4.3%	1.2%	3.7%	2.9%	2.1%	1.0%	0.4%	3.1%	1.9%	5.3%	7.3%	18.4%	26.0%	4.3%	4.4%	1.0%
Manufacture of paper and paper products	2.9%	2.2%	2.2%	2.8%	2.4%	3.2%	3.6%	2.6%	2.0%	3.9%	3.3%	2.2%	1.4%	15.2%	2.1%	4.1%	1.9%	2.5%	0.3%	2.7%	2.3%	2.7%	2.2%	3.7%	2.4%	1.3%	0.0%	1.7%	1.4%
Printing and reproduction of recorded media	2.0%	1.4%	1.9%	3.1%	2.0%	1.7%	2.8%	1.9%	1.9%	1.7%	1.6%	1.3%	1.2%	1.6%	1.2%	2.0%	1.3%	0.8%	1.3%	1.9%	1.8%	1.9%	3.4%	1.8%	2.9%	3.2%	3.7%	2.6%	14.6%
Manufacture of coke and refined petroleum products	1.6%	1.2%	0.2%	1.2%	2.4%	3.4%	4.1%	2.6%	4.2%	1.3%	1.8%	0.3%	0.0%	0.0%	4.1%	4.0%	0.0%	0.0%	0.0%	16.4%	0.0%	1.4%	0.2%	0.0%	1.8%	0.1%	0.0%	0.0%	0.0%
Manufacture of chemicals and chemical products	7.0%	9.2%	8.6%	6.4%	5.7%	8.6%	5.3%	15.9%	16.4%	6.4%	6.3%	5.1%	7.5%	8.8%	7.6%	4.1%	3.0%	2.7%	8.4%	3.2%	5.1%	6.3%	2.8%	9.0%	3.4%	2.3%	7.9%	2.6%	3.8%
Manufacture of basic pharmaceutical products and pharmaceutical preparations	5.8%	3.2%	5.5%	4.5%	2.5%	4.5%	1.7%	3.5%	15.0%	3.8%	6.4%	1.3%	24.8%	5.3%	6.9%	2.3%	1.9%	0.6%	34.6%	5.0%	10.5%	2.1%	5.5%	3.0%	0.4%	3.8%	0.0%	11.0%	0.0%
Manufacture of rubber and plastic products	5.7%	5.7%	5.1%	6.1%	5.9%	5.7%	8.6%	4.8%	4.4%	4.8%	3.4%	8.8%	4.0%	4.0%	7.2%	6.3%	8.0%	10.4%	1.8%	4.6%	8.4%	6.0%	4.5%	5.7%	4.0%	2.5%	0.0%	2.8%	0.0%
Manufacture of other non-metallic mineral products	4.1%	2.2%	3.8%	4.5%	3.7%	5.2%	6.1%	3.1%	5.0%	5.1%	3.6%	5.4%	4.6%	4.2%	3.7%	6.5%	4.9%	4.4%	2.4%	5.4%	4.0%	6.3%	6.9%	4.2%	3.9%	7.6%	20.8%	10.9%	12.4%
Manufacture of basic metals	4.0%	4.3%	2.5%	4.6%	2.7%	4.8%	3.5%	3.5%	6.3%	8.3%	7.1%	3.5%	1.3%	7.5%	3.5%	2.3%	4.2%	8.8%	1.1%	6.1%	6.8%	8.0%	2.0%	0.3%	0.9%	0.3%	0.0%	1.9%	0.1%
Manufacture of fabricated metal products, except machinery and equipment	10.8%	11.1%	8.9%	13.7%	10.4%	10.7%	11.2%	11.4%	7.6%	12.7%	10.8%	13.1%	8.4%	10.3%	7.3%	11.3%	7.7%	12.6%	3.3%	6.1%	15.2%	13.2%	14.2%	7.3%	12.8%	8.9%	22.8%	8.6%	11.8%
Manufacture of computer, electronic and optical products	4.8%	6.6%	4.6%	3.0%	5.5%	1.4%	3.4%	6.3%	2.6%	5.0%	3.9%	4.3%	7.2%	10.9%	9.7%	1.9%	3.1%	4.9%	7.3%	1.1%	3.2%	3.4%	3.9%	3.7%	5.7%	5.0%	0.0%	0.4%	0.0%
Manufacture of electrical equipment	5.5%	8.3%	4.4%	5.0%	3.2%	3.9%	4.3%	4.0%	2.4%	9.3%	4.3%	8.3%	3.6%	6.2%	20.9%	3.6%	4.4%	7.1%	1.1%	2.5%	11.1%	5.8%	5.7%	2.6%	6.6%	3.3%	2.9%	2.0%	7.3%
Manufacture of machinery and equipment	12.7%	21.3%	8.9%	7.1%	11.0%	10.8%	10.5%	3.9%	4.5%	7.1%	18.5%	23.3%	1.2%	2.2%	20.9%	6.4%	24.6%	25.3%	0.6%	0.3%	9.0%	3.7%	1.6%	3.0%	5.3%	5.2%	2.5%	0.6%	0.4%
Manufacture of other transport equipment	3.8%	3.3%	9.6%	4.0%	8.3%	3.5%	2.0%	2.4%	1.8%	1.8%	4.0%	1.9%	0.7%	1.8%	0.8%	0.9%	2.7%	0.8%	0.1%	1.1%	0.4%	1.0%	2.3%	0.8%	0.8%	0.0%	0.1%	0.0%	
Manufacture of furniture	1.8%	1.5%	1.0%	3.0%	2.2%	1.7%	4.2%	2.3%	1.1%	2.8%	1.3%	1.3%	2.6%	1.3%	1.0%	2.8%	3.2%	2.1%	0.7%	1.1%	2.0%	2.4%	3.1%	11.5%	5.7%	3.5%	0.7%	2.1%	7.1%
Other manufacturing	2.9%	3.4%	3.0%	3.2%	2.6%	1.4%	1.6%	1.9%	1.2%	2.5%	2.0%	2.5%	10.2%	1.0%	2.6%	1.6%	1.2%	1.2%	11.8%	0.9%	2.3%	3.3%	1.2%	2.6%	1.8%	1.4%	3.1%	1.7%	0.0%
Repair and installation of machinery and equipment	4.0%	3.0%	5.0%	3.6%	4.1%	3.5%	4.4%	5.5%	3.3%	3.9%	2.7%	3.8%	2.8%	3.4%	2.4%	3.2%	2.3%	3.3%	1.2%	2.5%	4.5%	3.8%	5.2%	4.8%	4.5%	5.4%	5.0%	8.7%	24.1%

* Data for 2016.

Source: author's own calculations, Eurostat data (sbs_na_sca_r2)



* Data for 2016 instead of 2017

Fig. 7. Share of manufacturing in gross value added, EU-28 in 2000, 2010 and 2019, %

Source: author's own calculations, Eurostat data (nama_10_a10).

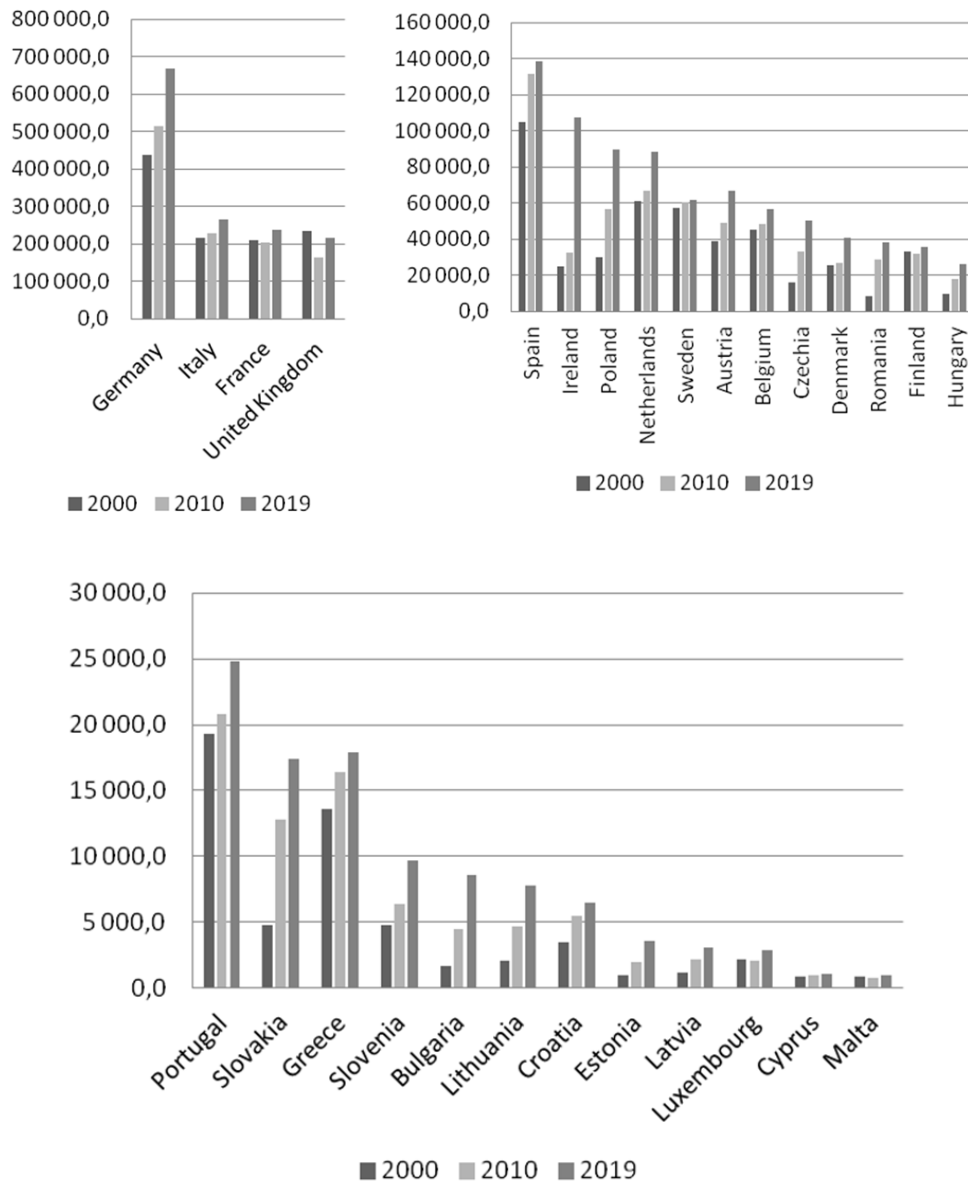


Fig. 8. Gross value added in manufacturing, EU-28, 2000, 2010 and 2019, million euros

Source: author's own calculations, Eurostat data (nama_10_a10).

The highest shares of manufacturing (industrial goods) in total exports in 2018 were registered in Czechia (87%), Finland (86.2%), Germany (85.5%), Slovakia (85.2%), Austria (83.6%), Hungary (82.8%), Italy (82.6%), Romania (82.5%), Poland (79.5%), Greece (79%), and France (78%) (Fig. 12). EU export deliveries are diversified, while the share of industry in total exports exceeds 80% in the Czechia, Finland, Germany, Slovakia, Austria, Hungary and some others. There are also countries where the share of industry in total exports does not reach 40%: Cyprus (21.6%), Belgium (35.6%), and Estonia (39.2%).

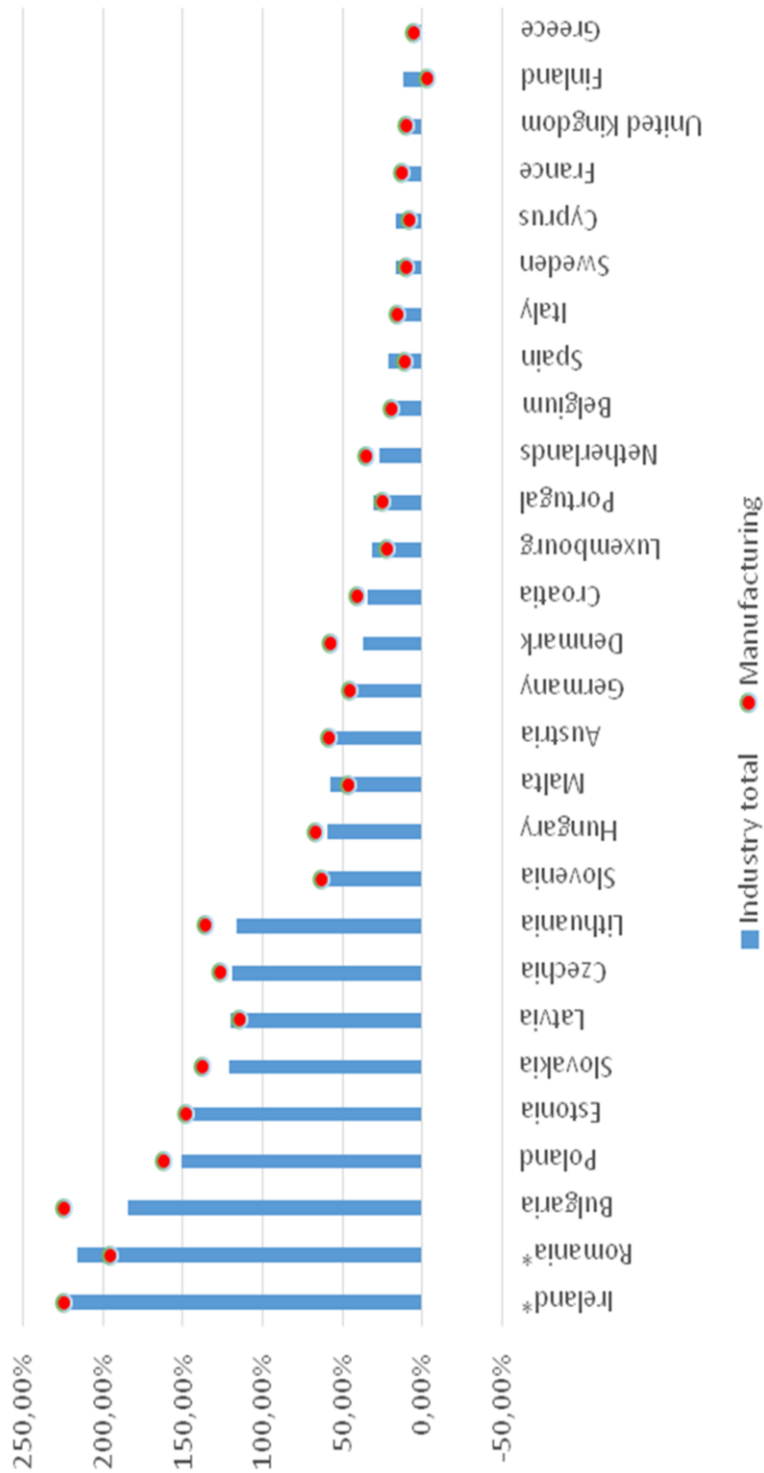


Fig. 9. Comparison of changes in gross value added of industry in general and manufacturing, EU-28, % change from 2004 to 2019

* Data for 2016.

Source: author's own calculations, Eurostat data (nama_10_a10).

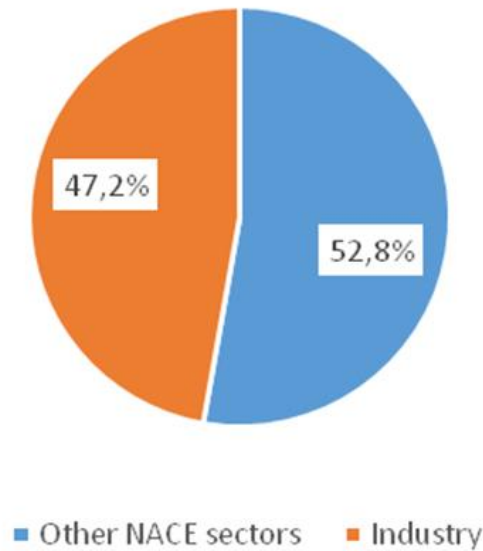


Fig. 10. Structure of import of the EU-28 countries outside the European Union in 2018, %
Source: author's own calculations, Eurostat data (ext_tec02).

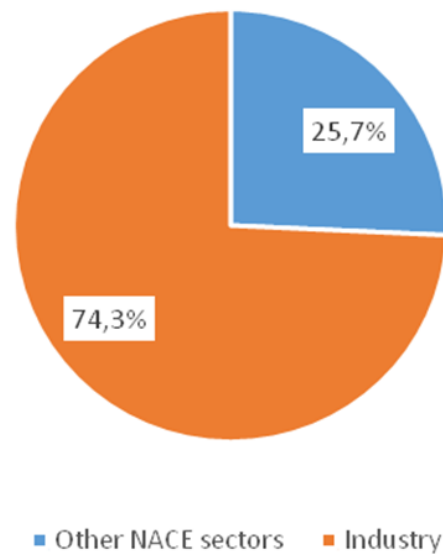
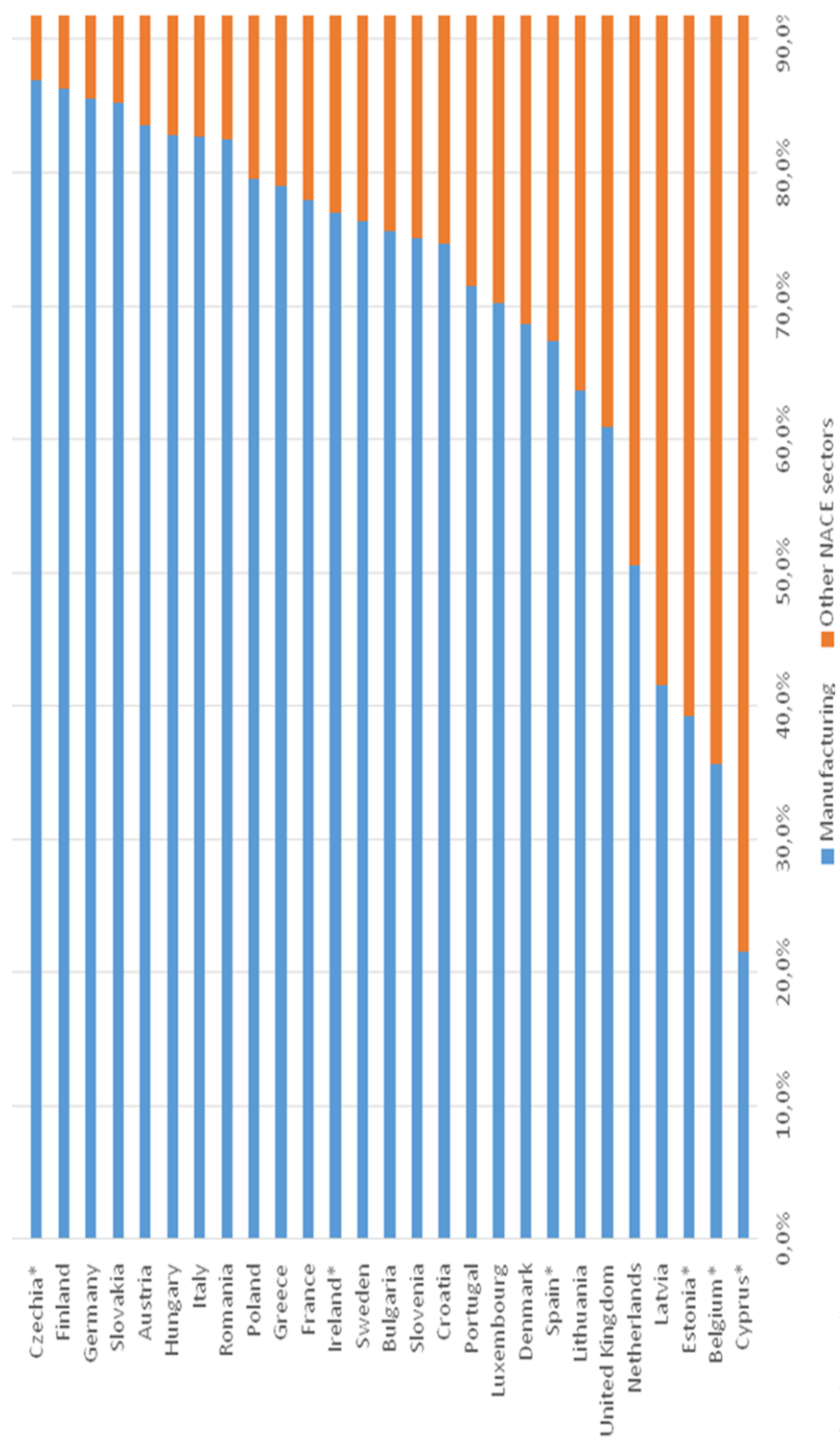


Fig. 11. Structure of exports of the EU-28 outside the European Union in 2018, %
Source: author's own calculations, Eurostat data (ext_tec02).

Changes in the structure of employment in industry and in labor productivity. Analysis of employment in certain sectors of the EU economy according to the classification NACE Rev. 2 shows (Fig. 13) that there the largest number of people are employed in the services sector (in 2018, 74.2% of total employees in the EU-28). Within the services sector, large shares are accounted for by sections G-I (wholesale and retail trade, transport and catering) and section O-Q (public administration, education and health and social work activities). In 2000, employment rate in the services sector was 66.1%, and in 2010, it increased to 71.8%..



2017, less Malta.

Fig. 12. Share of manufacturing in the structure of exports of the EU-28 countries outside the European Union in 2018, %

Source: author's own calculations, Eurostat data (ext_tec02).

The highest increase in employment in the EU-28 economy (in 2000–2019) was recorded in the M-H sector (professional, scientific, technical, administrative and support services) (by 4.1%). As to the goods-producing sectors, there has been a decline in sector A (agriculture, forestry and fisheries) from 2000 up to -3.7%, in sectors B-E (industry) – up to -4.1%, and in F (design) - up to -0.4%.

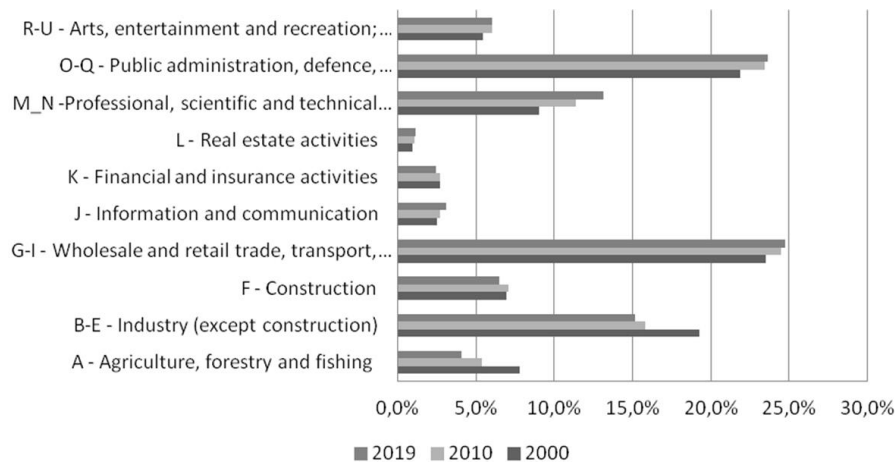


Fig. 13. Share of main NACE sectors in employment, EU-28 in 2000, 2010 and 2019,
% of the total employed population in respective year

Source: author's own calculations, Eurostat data (nama_10_a10_e).

The share of industrial employment in CEE countries that joined the EU after 2000 is higher than in all other member states. In 2019, the highest share of persons employed in industry relative to total country employment was recorded in Czechia (28.7%), Poland (24.1%), Slovakia (23.9%), Slovenia (23.2%), Romania (21.6%), Hungary (21.2%), Croatia (21%), Estonia (20.1%), and Bulgaria (20%), but in all these countries such employment in absolute terms in 2000–2019 decreased as a result of structural changes in the EU's industrial policy and the economic crisis of 2009, which had an pronounced impact on industry. The country where the share of employed in industry (Fig. 14) relative to total employment in the analyzed period decreased the most is Malta (14.3%). Ireland (7.6%), Spain (7.1%), Slovenia (6.3%), Finland (6.3%), and Luxembourg (6.2%) also showed a decrease.

In the EU-15 in 2017, the largest shares of industrial employment in EU-28 were demonstrated by the following countries: Germany (18.5%), Portugal (17.1%), Italy (16.8%), Austria (16, 1%) and Finland (14.1%). However, the largest reductions in the share of industrial employment relative to total employment during 2000–2019 in the EU-15 countries were registered in Spain - 7.1%, Finland - 6.3%, Luxembourg - 6.2%, Sweden - 5.8 %, Great Britain - 5.7%, Belgium - 5.4%, Ireland - 4.8%, Denmark - 4.8%, Portugal - 4.6%, and Italy - 4.4% (Fig. 17 and 18). If we split employment in the industrial sector into four main sections (B, C, D and E), then it is clear that the most important segment is manufacturing (section C) (Fig. 15 and 16).

Among the countries with the highest industrial employment, Germany has traditionally been a recognized leader in the EU. Besides, the level of employment in German industry was also stable. During 2010–2017, approximately 7.7 million people worked there on average. Employment in German industry remained stable during 2010–2017, while overall EU industrial employment declined.

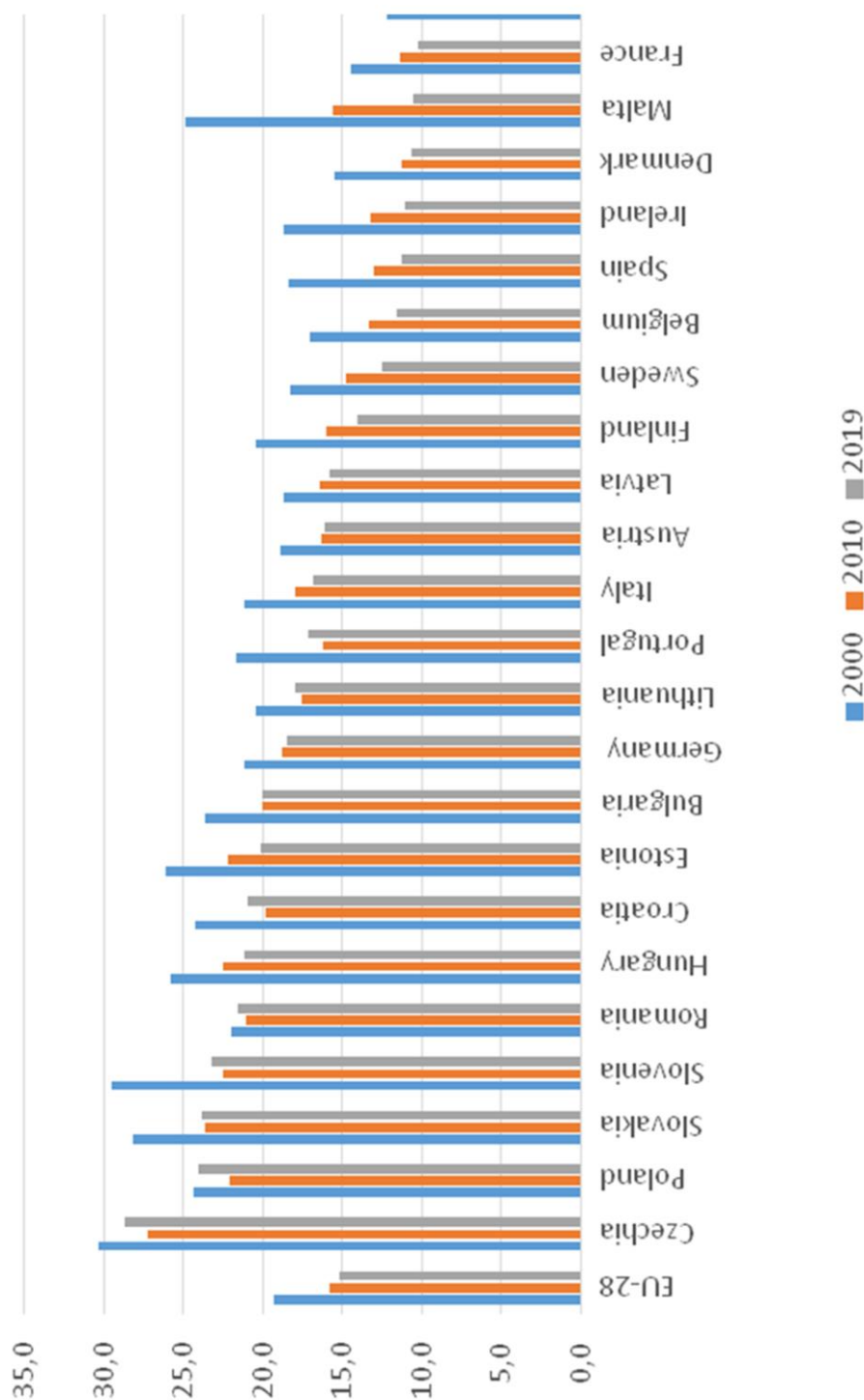


Fig. 14. Share of industrial employment in EU-28 in 2000, 2010 and 2019, % of total country employment

Source: author's own calculations, Eurostat data (nama_10_a10_e).

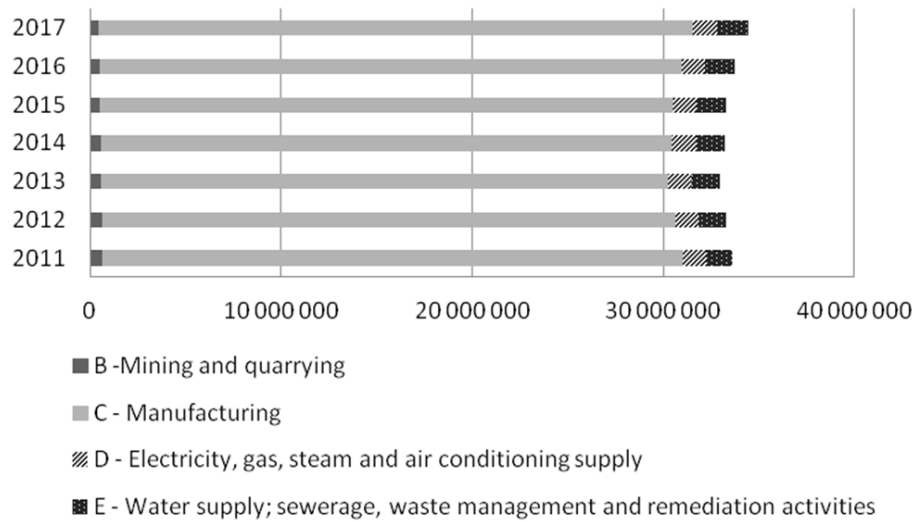


Fig. 15. Structure of industrial employment in EU-28 in 2011–2017, persons

Source: author's own calculations, Eurostat data (sbs_na_sca_r2).

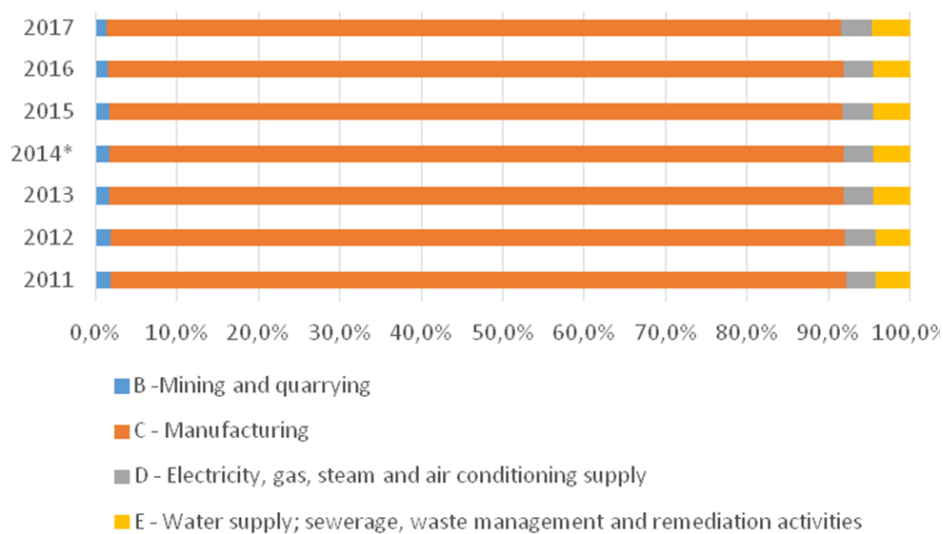
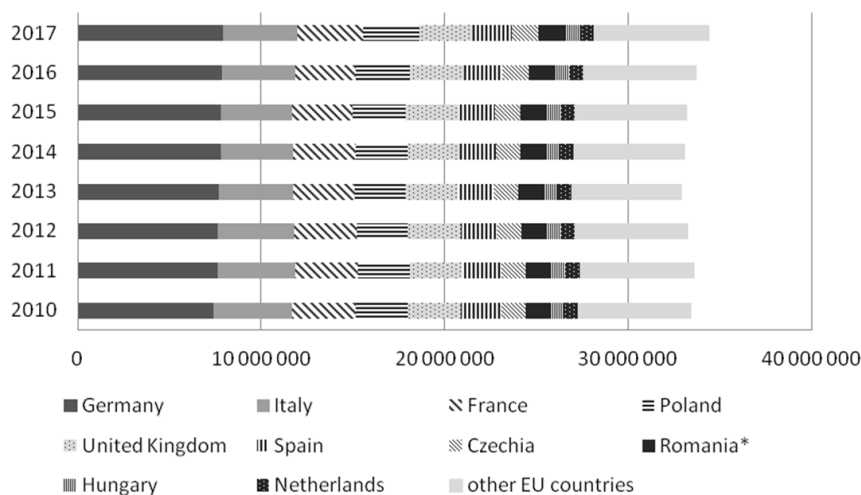


Fig. 16. Structure of industrial employment in EU-28 in 2011–2017, %

Source: author's own calculations, Eurostat data (sbs_na_sca_r2).

Other countries with a high level of industrial employment compared to other EU member states in 2017 included Italy (4.06 million people), France (3.6 million people), Poland (3.1 million people) and the United Kingdom. (2.9 million people). But by 2015, industrial employment growth only took place in Germany (by 1.3%). In other EU-28 countries, industrial employment declined. An exception was 2019, when there was a slight increase.

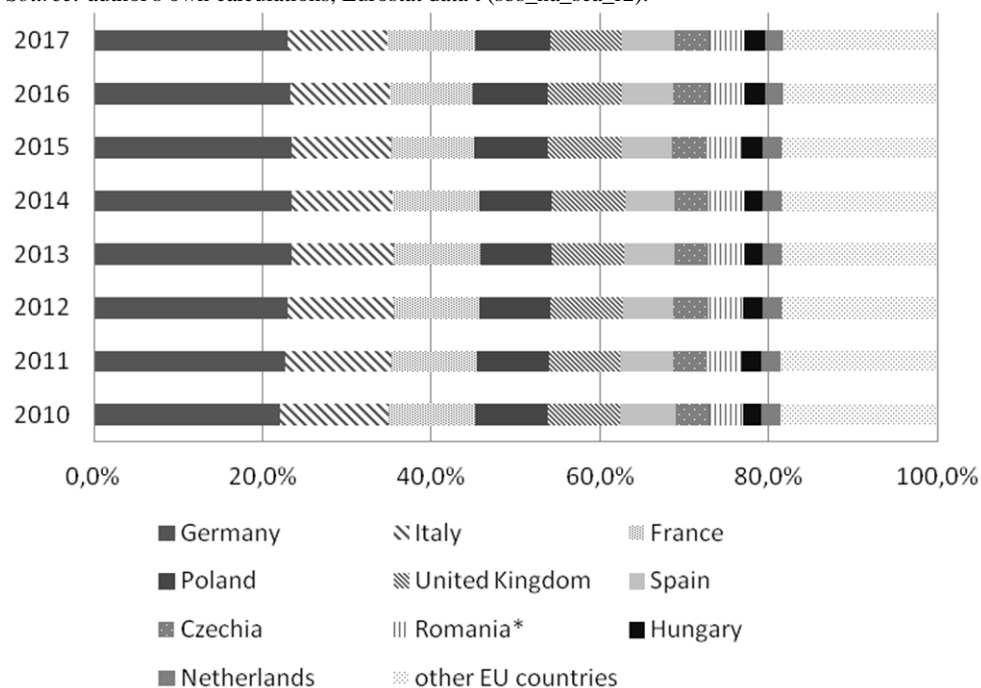
If we compare the employment rates in industry (and in manufacturing) of the EU member states in 2019 with the figures of 2004, we can see that they decreased in all countries. In the rest of the countries, employment in industry and in manufacturing both in 2000 and in 2017 generally decreased, the most in Malta (-14.3 and -11.9%), Ireland (-7.6 and -7.4%, respectively), Spain (-7.1 and -7.3% respectively), and Slovenia (-6.3% and -6.1% respec-



* less data for Malta and Cyprus.

Fig. 17. Top ten countries by the share of industrial sector in total employment in EU-28, 2010-2017, persons

Source: author's own calculations, Eurostat data t (sbs_na_sca_r2).



* less data for Malta and Cyprus.

Fig. 18. Top ten countries by the share of industrial sector in total employment in EU-28, 2010-2017, %

Source: author's own calculations, Eurostat data (sbs_na_sca_r2)

tively), Spain (-7.1 and -7.3% respectively), and Slovenia (-6.3% and -6.1% respectively), and the least in Poland (-0.3%) and Romania (-0.4%) %. It is also worth noting that in most EU member states the employment decline in manufacturing was greater than the overall decline in industrial employment (Fig. 19).

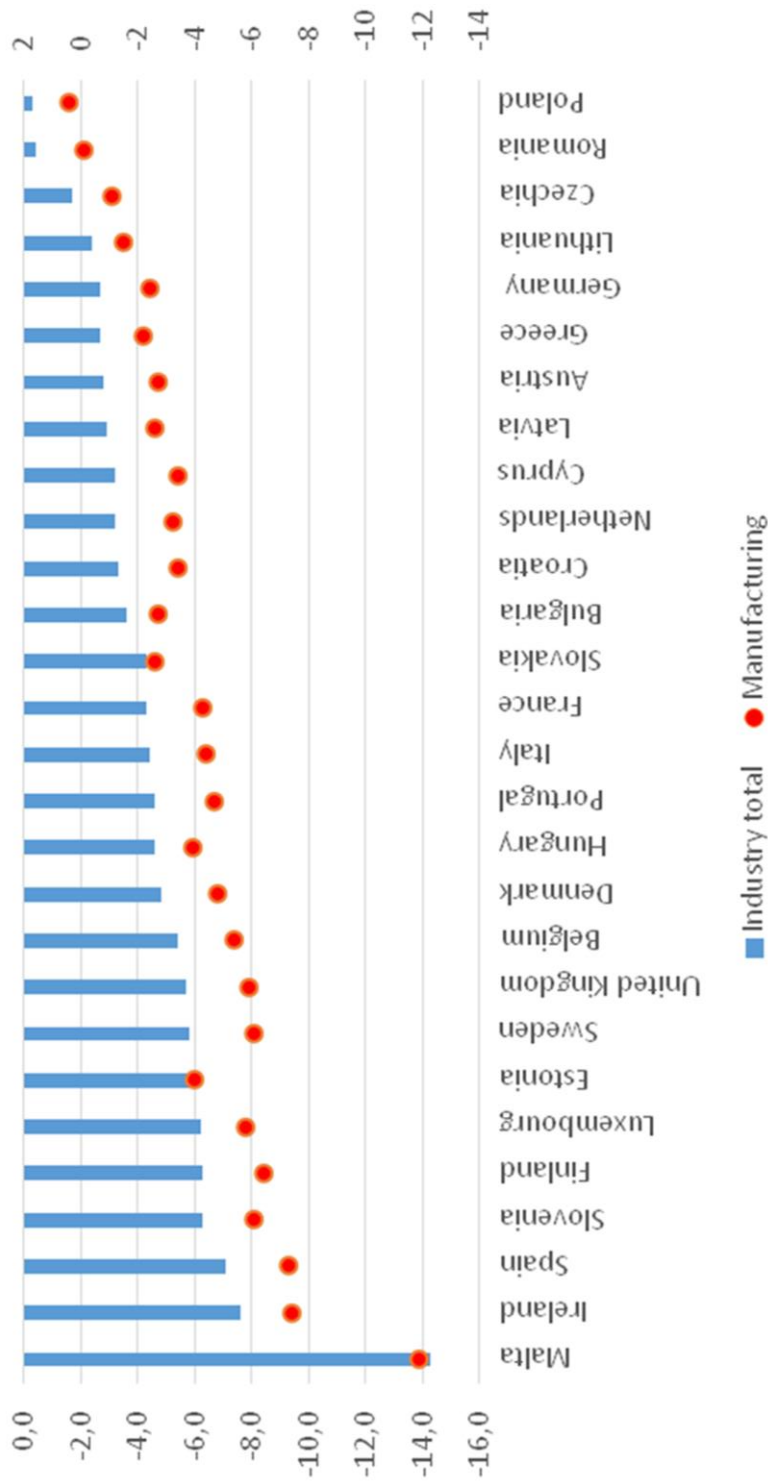


Fig. 19. Changes in employment in industrial and manufacturing¹ sectors of EU-28 in 2000–2019, %

Source: author's own calculations, Eurostat data (nama_10_a10_e).



Labor productivity in the industry of the European Union. An important element for the analysis of EU industry is the changes in labor productivity. In this study, labor productivity in the EU industry is measured as gross value added per employee. Currently, in the industry of EU countries, we observe an increase in productivity (Fig. 20).

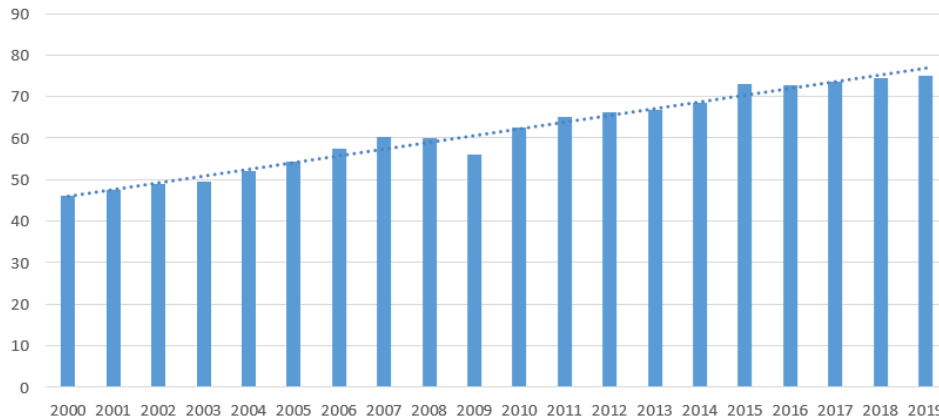


Fig. 20. Labor productivity in the industrial sector of EU-28 (gross value added per employee) in 2000–2019, in euros

Source: author's own calculations, Eurostat data (nama_10_a10_e; nama_10_a10).

A significant overall improvement in labor productivity in the EU industry can be seen from the ratio of gross value added to industrial employment in 2000–2017 (Fig. 21). An upward trend in labor productivity in the EU-28 industry could be observed already before the crisis of 2009. Factors that contributed to the decline in industrial employment in the EU included restructuring of industrial costs (offshore outsourcing outside the EU), and progressive automation and digitalization (as a result, GVA per employee increased).

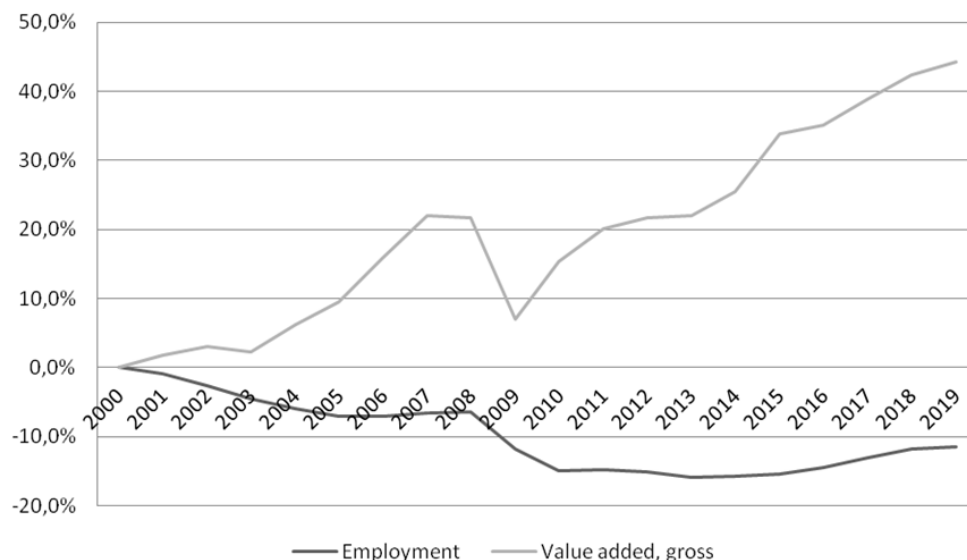


Fig. 21. Increase in gross value added and employment (compared to 2000) in the industrial sector of EU-28 in 2000–2019, %

Source: author's own calculations, Eurostat data (nama_10_a10_e; nama_10_a10).

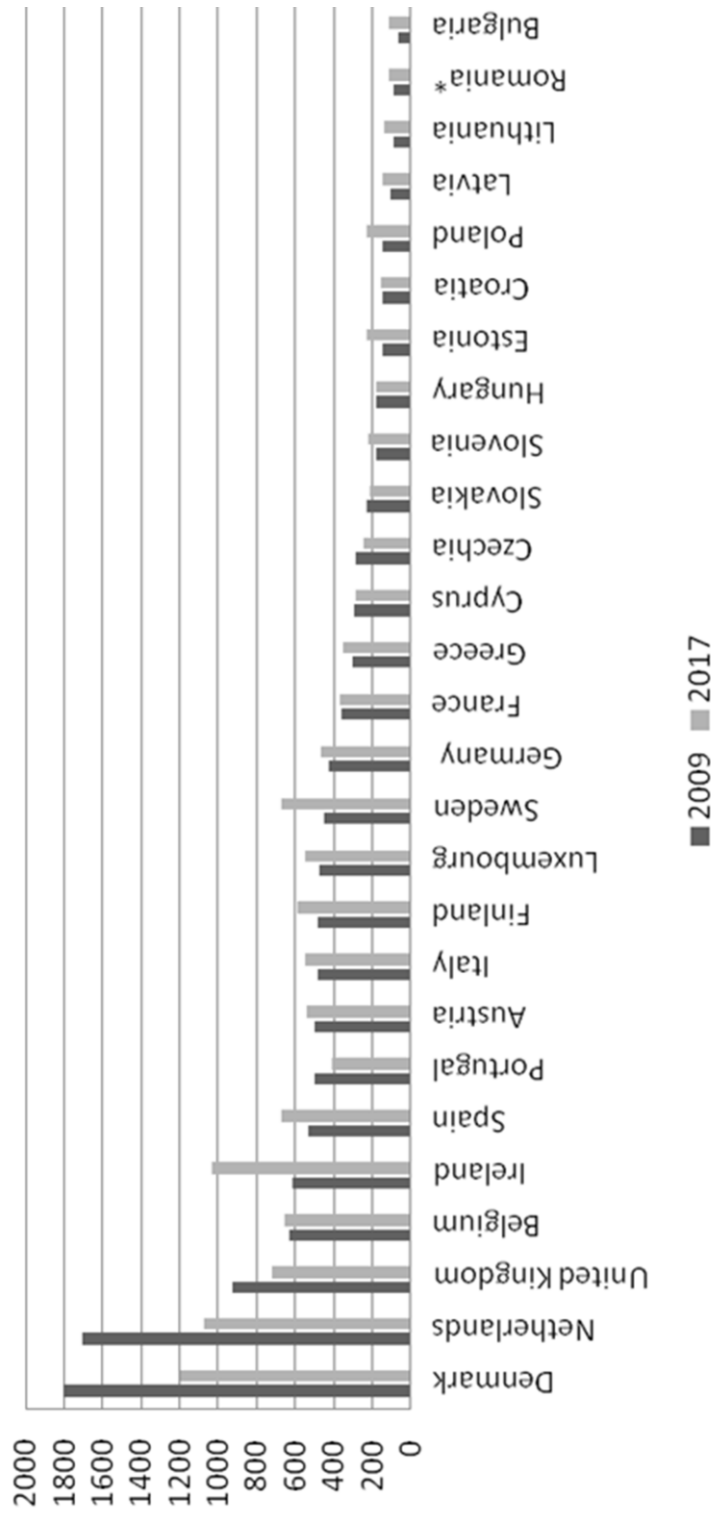


Fig. 22. Change in labor productivity in the industrial sector by countries of the EU-28 in 2000–2017, thousand euros

Source: author's own calculations. Eurostat data (nama 10 a10 e: nama 10 a10).

Analyzing labor productivity in the industry of EU member countries separately in 2000 and 2017, we can see that the variation is very large (Fig. 22). First, industrial labor productivity is much higher in the EU-15 than in the countries that joined in 2004 and later. Second, the highest labor productivity in industry during the analyzed period was recorded in Denmark, Sweden, Belgium, the Netherlands, Finland, Great Britain, Austria and Luxembourg. In all these countries, industrial labor productivity increased significantly during the years analyzed. Third, the lowest industrial labor productivity was recorded in the new member countries, in particular in Bulgaria, Romania, Croatia, Poland and Latvia; however, during 2000–2017, these countries also showed a 2–4-fold increase. If we compare labor productivity in industry (as well as in manufacturing alone) of EU member countries in 2017 with the base year 2000, we see that the largest increase during these years was recorded in Romania (505.1%), Ireland 442.5%), Bulgaria (361%), Estonia (347%), Lithuania (294%), Slovakia (251%), and Latvia (227%), i.e. in the new EU member states. In other EU member states (except for the United Kingdom and Cyprus), the growth was somewhat over 40% (Fig. 23).

The economies of the former group greatly benefited from technology transfer from more developed countries, with a recorded statistically significant effect of productivity growth due to domestic innovative activities and market reforms oriented to liberalization and privatization. However, the most important role was performed by the effect of transfer of the factors of production within the industrial sector towards the more productive activities [15].

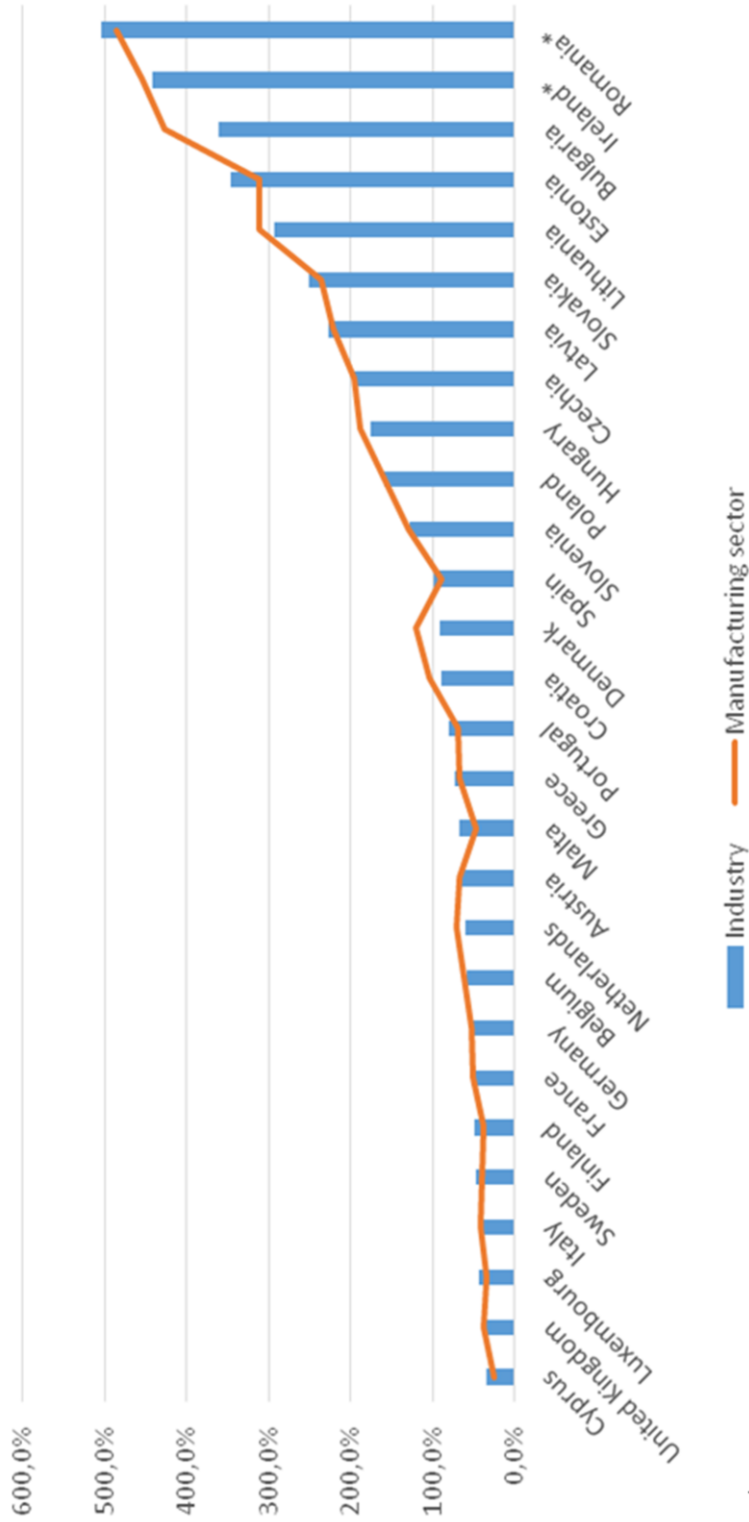
Conclusions

Analysis reveals the problems that exist today in European industry. Some of them can be solved via changing the vector of industrial policy and increasing the competitiveness of the industrial sector. The transition to the technologies of the fourth industrial revolution would bring improved productivity, but would also lead to reduced employment, and there is a tendency to increased share of services in the economy, including those provided for industrial needs.

The European Commission notes the factors that have led to a decline in the role of industry and the growing importance of services in the EU-28 economy, such as higher elasticity of demand for some services (e.g. education, health, leisure and personal services, etc.) than for industrial goods; and use of services by manufacturing / industrial companies at an intermediate stage. Other factors that led to decreased share of industry include the relocation of production to countries where the cost of production is lower (outside the EU), in particular processes like offshoring and outsourcing. Among the important problems, first, should be mentioned the current trend of decrease in the industrial sector in the EU (V-E categories), which since 2000 has reached 3.54%.

The decline occurred for all groups of countries (by the time of their accession to the EEC / EU), with the exception of Ireland (which is now called the "Celtic Tiger"), the share of industry in the economy since 2000 has declined. In the countries that joined in the 1990s, the decrease was 6%, in the founding countries - 4%, and in Croatia – 4%.

Second, the share of mining in the EU has decreased both in output and employment, in particular due to a change in the base for extraction and relocation to other countries. Third, there is a decrease in industrial and, consequently, there is a need for retraining of these workers. This trend is all-Europe and characteristic of all countries without exception. Factors that led to the decline in industrial employment include restructuring of industrial costs (offshore outsourcing in countries outside the EU), and progressive automation and digitalization (as a result, GVA per employee increased). On the other hand, the trend helped increase overall productivity in the EU.



Note: data for Ireland and Romania are for 2016.

Fig. 23. Change in labor productivity in the industrial sector of EU-28 from 2000 to 2017, %

Source: author's own calculations, Eurostat data (nama_10_a10_e; nama_10_a10).



The present study of labor productivity trends shows that this indicator was much higher in the EU-15 than in the CEE member countries. The highest productivity is currently recorded in Ireland, Spain, Luxembourg, and Sweden; while Bulgaria, Lithuania, Romania and Latvia - in contrast to the CEE countries - had the lowest levels of labor productivity in industry.

Germany, Italy, France, Great Britain, and Spain remain the core of industry in terms of the generation of gross value added and the share of employed in industry. It is noted that traditionally European industry is concentrated around the "blue banana" - a corridor from northwest England to northern Italy through the Benelux countries, western Germany and eastern France. This trend continues to this day. Most European researchers of industrial policy are convinced in the importance of technological and innovative development provided via horizontal and sectoral methods; competition policy (definition of state aid rules, etc.); and trade policy, which is also conducted by sectoral methods, and of the development of education and science base. Strengthening the competitiveness of EU industry requires a systematic approach to policy formulation and implementation.

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СТРУКТУРНІ ТРАНСФОРМАЦІЇ ПРОМИСЛОВОГО СЕКТОРА ЄВРОПЕЙСЬКОГО СОЮЗУ

Питання промислової політики та проблем промисловості є одним із найбільш дискусійних у європейській науковій спільноті. Навіть сьогодні ми бачимо наявний брак теоретичного підґрунтя для прийняття рішень щодо проблем промислової політики. Головна мета публікації – оцінити внесок промисловості у соціально-економічний розвиток ЄС та його країн-членів, а також динамічних структурних зрушень, що відбулися протягом 2000–2019 рр.

Для досягнення мети статті в роботі використовуються такі індикатори, як частка промислового сектора у створенні валової доданої вартості, зайнятості, продуктивності праці, експорті/імпорті. Виявлено загальну тенденцію щодо зростання частки сектора послуг у створенні валової доданої вартості для ЄС-28 та до зменшення частки промислового сектора. Встановлено, що промисловість залишається важливим сектором для економіки ЄС, а для ЄС-28 вона забезпечує майже 20% валової доданої вартості, понад 70% загального експорту, близько 15% зайнятого населення. Для кожної з держав ЄС внесок промисловості у соціально-економічний результат різний – для країн Центральної та Східної Європи він є більш важливим у створенні валової доданої вартості та зайнятості, ніж для країн, фундаторів євросони, – групи країн ЄС-15. Виявлено, що продуктивність праці в ЄС-15 більша, ніж в інших країнах. Зростаюча продуктивність праці характерна для Данії, Нідерландів, Ірландії, Швеції, Великої Британії, нижча – для країн Центральної та Східної Європи – Болгарії, Румунії, Литви, Латвії. Хоча зростання всіх показників щодо промисловості в останніх країнах є набагато більшим, ніж у ЄС-15.

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Structural transformations ...

Розглянуто концепцію нової промислової політики Європейського Союзу та проблеми промислового сектора в ЄС.

Дослідження проводилося автором на статистичній базі Європейської Комісії із використанням методології польських науковців Варшавської школи економіки з дослідження нової промислової політики (Krzysztof Falkowski, Adam A. Ambroziak, 2015).

Ключові слова: промисловість, галузева структура промисловості, валова додана вартість промисловості, зайнятість, експорт, імпорт, додана вартість у виробництві, продуктивність праці, ЄС