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Economy and Society in the Face of New Challenges

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2020, t. 90, nr 3

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Wiesława Caputa

Wydawnictwo
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Introduction

It is commonly observed that the modern global economy is shaped by increasingly frequent breakthrough changes. In spite of the continuous material and technological progress taking place in the world, the symptoms of chaos, asymmetry and dysfunctionality in the economic, social and ecological sphere are becoming more and more evident, which is particularly obvious during the COVID-19 pandemic.

The world's economies and societies are facing new challenges, which are associated, among other things, with the necessity to create economic policy capable of minimising threats resulting from changes in the environment, to focus efforts on building an information society, to effect a structural transformation of some industries, to ensure broadly understood security, to make the best use of the income, development and intellectual potential of communities. These are some of the problems that are addressed by articles included in the current issue.

The article by Andriy Pekhnyk and Yuliia Borzak entitled *The impact of the Covid-19 pandemic on the European economy: A first glance and long-term perspectives* outlines the influence of the COVID-19 pandemic on the economies of EU member states. The analysis of short- and long-term effects of the pandemic is based on data about the intra- and extra-EU trade balance, imports and exports and takes into account possible future effects, possible multiplier effects as well as ways of improving the economic policy aimed at minimizing present and long-term risks for the EU economy.

Nataliya Ryvak and Anna Kernytska in their article entitled *Ukraine's industrial transformation models in the context of the EU experience* compare models of industrial transformation in Ukraine with those observed in UE countries. Particular attention is paid to obstacles hindering the successful implementation and enforcement of the I4.0 policy in the European countries as well as factors conducive to its successful implementation. Drawing on the analysis of the European experience of the digital transformation in industry and national

economies in general, the authors highlight critical areas in need such transformations in Ukraine.

In the article entitled *A comparative assessment of intersectoral relations of the woodworking industry: Ukraine, Poland, Germany*, Svitlana Ishchuk, Lyubomyr Sozanskyy identify the key problems and characteristics of the development of the woodworking industry by comparing the closeness of intersectoral ties and the cost of woodworking production in Ukraine and EU member states. They conclude that the Ukrainian wood processing industry requires a structural transformation.

Olena Liahovska, the author of the article entitled *Export of flour and flour-based products in Ukraine: trends and problems* identifies the main problems affecting the development of the flour industry in Ukraine, indicating several ways of improving its competitiveness, such as the introduction of innovative technologies for growing grain crops, the use of more advanced technical equipment in flour mills to improve the quality of finished products while meeting the requirements of world standards; incentives to stimulate cooperation and integration (horizontal-vertical) of agricultural and industrial producers in the processes of primary processing, procurement and sale of manufactured products; improvement of promotion and logistics of products of the domestic food industry in the world market in order to avoid potential losses in price and quality.

In the article *Implementation of EU regional policy in the conditions of exclusive regulation of the economy*, Halyna Bublei, Anatoliy Mokiy, Juliia Poliakova and Svetlana Schultz analyse the concepts of divergence and convergence in relation to the process of Ukraine's integration with the EU and identify a number of factors inhibiting the convergence process. By making comparisons with Ukraine's trading partners, they are able to propose a number of systemic solutions that could stimulate this process.

Kateryna Antoniuk, Anatoly Mokiy, Dmytro Antoniuk, the authors of the article entitled *Analysis of consumption in the process of sustainable development: a regional aspect* propose an composite indicator to classify countries in terms of the level of consumption. The indicator reveals the uneven distribution of consumption in the world, which is determined by the GDP, population and quality of life in the analysed countries. The authors identify relationships between the composite indicator of the level of consumption of goods (services) by households and GDP per capita and as well as the Human Development Index. They also provide correlations of separate indicators of financial capacity and the level of well-being of the population with indicators of the level of consumption. This taxonomic analysis is used to determine the level of consumption in Ukraine.

The purpose of the article **I**ryna Storonyanska, Liliya Benovska entitled *Management of the development of united territorial communities under the*

assets-based approach is to conceptual approaches to management with emphasis on asset-oriented management of a united territorial community.

Each united territorial community in Ukraine has its own resource base, but its successful development depends not only on the availability of resources, but also on the ability to turn them into development assets. Therefore, when talking about managing the assets of united territorial communities, one should focus on two aspects: the community's own resource base of and its effective management with a view of transforming this resource into a community asset. The authors analyse different conceptual approaches to management, making comparisons and highlighting opportunities and expediency of their application for the purpose of managing territorial communities. As they point out, the goal of asset-oriented management is to increase the community's capacity by mobilizing its own resources and transforming them into development assets.

The last article in the collection, written by Vasyl Antoniv, Nataliia Datskiv, Iryna Paslavska describes *A study of the cycle of electricity consumption and production in Ukraine using the Monte Carlo method.* The authors a simulation model to forecast electricity production in Ukraine. The following indicators were taken into account in the model: predicted consumption intervals for all consumer groups; medians and standard deviations of electricity consumption intervals; average percentage of (net) electricity consumption relative to total electricity generation.

The articles present a fragment of reality, which should be of interest not only to scientists and students but also to those practically involved in the fields described by the authors. They contribute to the current scientific discourse and justify the need for more research, especially concerning the impact of the COVID-19 pandemic on the economy and society.

Wiesława Caputa, PhD

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The impact of the COVID-19 pandemic on the European economy: A first glance and long-term perspectives

Abstract. *The paper outlines the influence of the COVID-19 pandemic on the economies of EU member states. The analysis of short- and long-term effects of the pandemic is based on data about the intra- and extra-EU trade balance, imports and exports and takes into account possible future effects, possible multiplier effects as well as ways of improving the economic policy aimed at minimizing present and long-term risks for the EU economy.*

Keywords: *COVID-19 pandemic, European economy*

1. Introduction

Nowadays European Union faces a big shock, caused by COVID-19 pandemic and spread to all spheres of people's life around the whole world. At least during the first half of this year, a negative economic impact upon Europe (as well as upon the entire world) has already materialized.

The COVID-19 crisis has affected societies and economies around the globe and will permanently reshape our world as it continues to unfold. While the fallout from the crisis is both amplifying familiar risks and creating new ones, change at this scale also creates new openings for managing systemic challenges, and ways to build back better.

This tendency will continue if the governments don't use effective tools to reduce a negative influence on the economy. Real GDP growth in 2020 might

fall to well below zero or even be substantially negative as a result of the COVID-19, and a coordinated economic response of EU institutions and Member States is key to mitigating the economic repercussions.

The goal of this article is to appreciate the present effects of COVID-19 pandemic upon the economy of European Union and to give some key suggestions to possible outcomes as well as to possible ways of minimizing the negative effects.

2. Short- and long-term effects of COVID-19 upon the EU economy

To understand how much COVID-19 has affected to the EU economy, let's look at the dynamics of the international trade over the last years. According to the analytical data from the official website of Eurostat [*Eurostat news release euro indicators* 2020], we have an international trade balance of the EU countries.

If we analyze solely the changes in trade balance of EU countries in 2020 compared to corresponding period of 2019, we will see no drastical changes (see Table 1).

Even more obvious it becomes if we represent those data as Chart 1. As we can see in Chart 1, decline in trade balance of most European countries was not drastical, while some countries showed even increase either in extra-EU trade balance (for example, Italy) or in intra-EU trade balance (Belgium, Netherlands) or even both (Germany, Ireland).

The only country with more or less substantial decline in general balance was France with modest (25/5%).

Therefore at first glance it may seem that COVID-19 pandemic influence upon EU trade was not really serious.

But the reality is totally different. Trade balance cannot be used as a trend indicator simply because it is balance, which means increase or decrease in exports unavoidably is being compensated by corresponding increase or decrease in imports – country that exports less has a strong tendency to decrease its imports just because of decrease of export gains reduction.

To prove this let's analyze trends in exports and imports separately (see Table 2).

Chart 2 shows us that almost all the EU-countries had a definite decline in exports if we compare 2020 statistics with corresponding data of 2019.

And even the sharp increase of a few countries (like Cyprus) is not a real increase, but rather reshaping exports from intra-EU to extra-EU, while overall trend is negative.

The same tendency we can see in imports (see Table 3).

Table 1. EU trade balance change January-April 2020 compared to January-April 2019 (total, intra-EU and extra-EU)

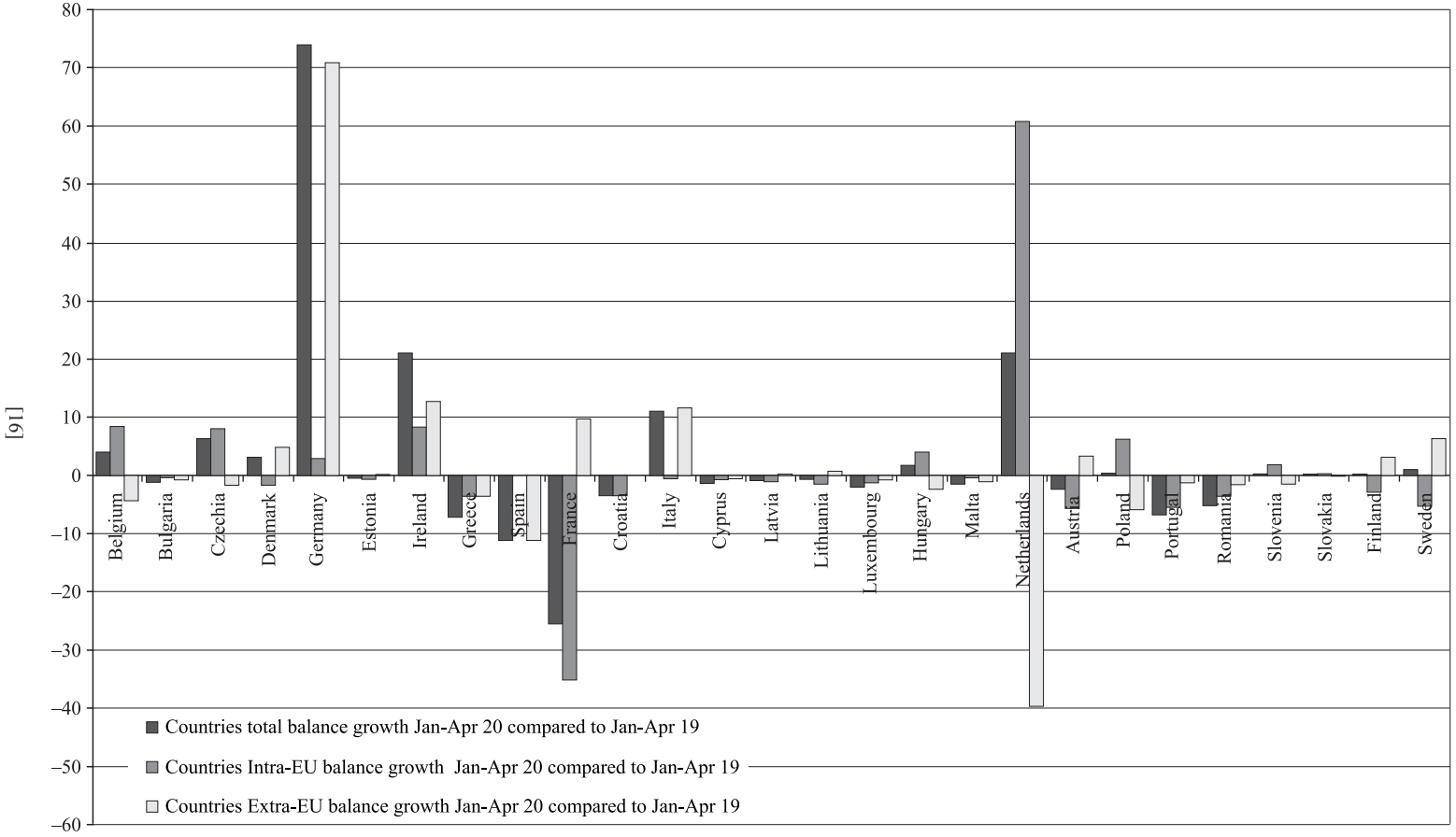
Country	Total balance	Intra-EU balance	Extra-EU balance
	growth January-April 2020 compared to January-April 2019		
Belgium	4.0	8.4	–4.4
Bulgaria	–1.2	–0.3	–0.8
Czechia	6.3	8.0	–1.7
Denmark	3.1	–1.7	4.8
Germany	73.9	2.9	71.0
Estonia	–0.5	–0.7	0.2
Ireland	21.0	8.3	12.7
Greece	–7.2	–3.6	–3.6
Spain	–11.2	0.0	–11.2
France	–25.5	–35.2	9.7
Croatia	–3.5	–3.5	0.0
Italy	11.0	–0.6	11.6
Cyprus	–1.4	–0.8	–0.6
Latvia	–0.9	–1.1	0.2
Lithuania	–0.7	–1.5	0.7
Luxembourg	–2.1	–1.3	–0.8
Hungary	1.7	4.0	–2.4
Malta	–1.5	–0.5	–1.1
Netherlands	21.0	60.8	–39.7
Austria	–2.4	–5.7	3.3
Poland	0.4	6.2	–5.9
Portugal	–6.8	–5.5	–1.3
Romania	–5.2	–3.6	–1.6
Slovenia	0.3	1.8	–1.5
Slovakia	0.2	0.3	–0.2
Finland	0.2	–2.9	3.1
Sweden	1.0	–5.3	6.3

Source: based on *Eurostat news release euro indicators* 2020.

The same converted to diagram (see Chart 3). Chart 3 shows obvious decline in imports in absolutely all (with no exceptions) EU countries. This can be explained not only by general purchasing reduction caused by quarantine, but also by increasing hesitations and doubts about future economic prospects.

We have to emphasize that these tables and figures show some kind of a "moment picture" of the present economic situation with the start of COVID-19 pandemic. But there also are even more dangerous tendencies.

Chart 1. EU trade balance change January-April 2020 compared to January-April 2019 (total, intra-EU and extra-EU)



Source: based on *Eurostat news release euro indicators* 2020.

Table 2. EU exports change January-April 2020 compared to January-April 2019 (total, intra-EU and extra-EU) in [%]

Country	Total exports	Intra-EU exports	Extra-EU exports
	growth January-April 2020 compared to January-April 2019		
Belgium	–7	–8	–5
Bulgaria	–4	–5	–3
Czechia	–12	–13	–9
Denmark	0	–6	7
Germany	–10	–11	–9
Estonia	–6	–6	–7
Ireland	6	8	5
Greece	–9	1	–19
Spain	–13	–13	–12
France	–16	–15	–18
Croatia	–6	–5	–10
Italy	–12	–11	–13
Cyprus	–16	–58	39
Latvia	–1	–2	0
Lithuania	–6	–5	–7
Luxembourg	–34	–33	–35
Hungary	–10	–12	–5
Malta	–3	–8	4
Netherlands	–5	–6	–4
Austria	–8	–7	–10
Poland	–7	–8	–1
Portugal	–12	–13	–10
Romania	–13	–15	–8
Slovenia	–3	–14	27
Slovakia	–16	–16	–18
Finland	–15	–15	–15
Sweden	–5	–9	0

Source: based on *Eurostat news release euro indicators* 2020.

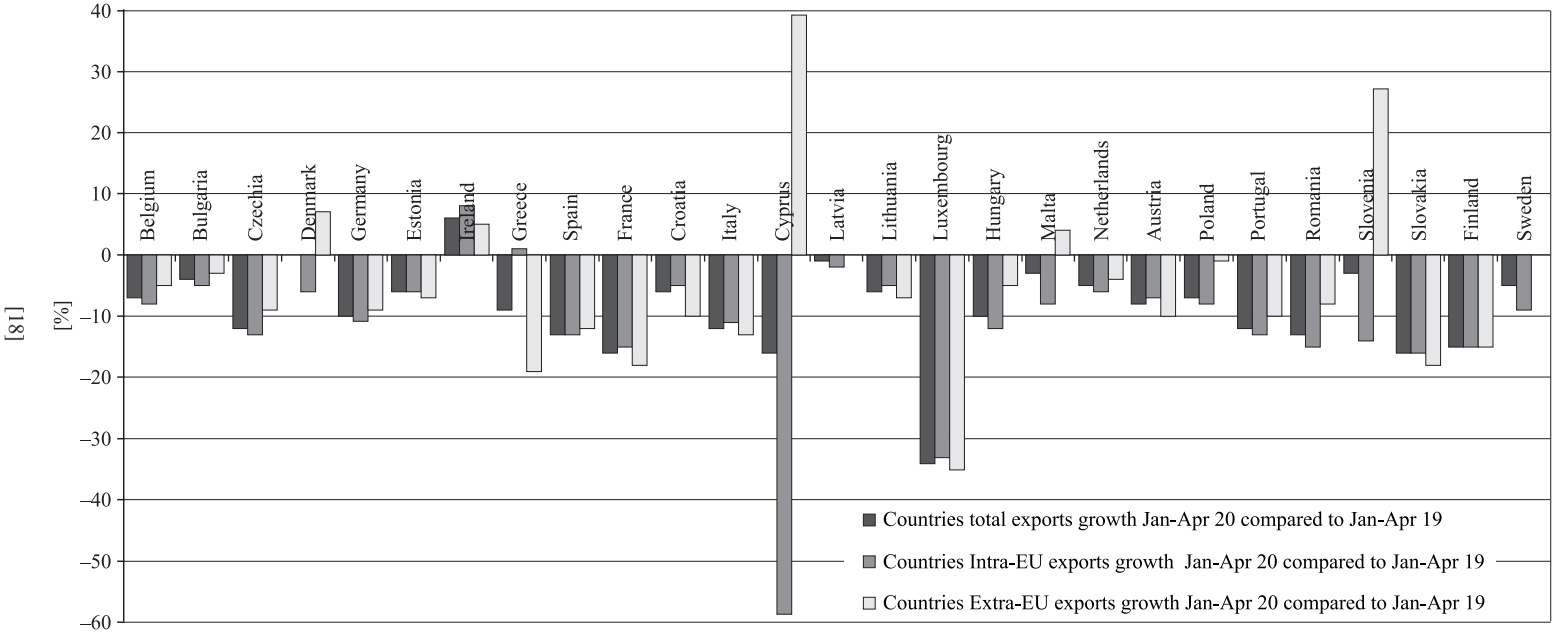
Let's illustrate them using statistics of new car registration data in some EU countries (see Table 4).

The same data in Chart 4.

The general trend becomes even more drastic if we compare change in new car registration solely in April 2020 to April 2019 (see Table 5).

The same data in Chart 5. This figure shows rapid fall almost to zero in some countries.

Chart 2. EU exports change January-April 2020 compared to January-April 2019 (total, intra-EU and extra-EU)



Source: based on *Eurostat news release euro indicators* 2020.

Table 3. EU imports change January-April 2020 compared to January-April 2019 (total, intra-EU and extra-EU) in [%]

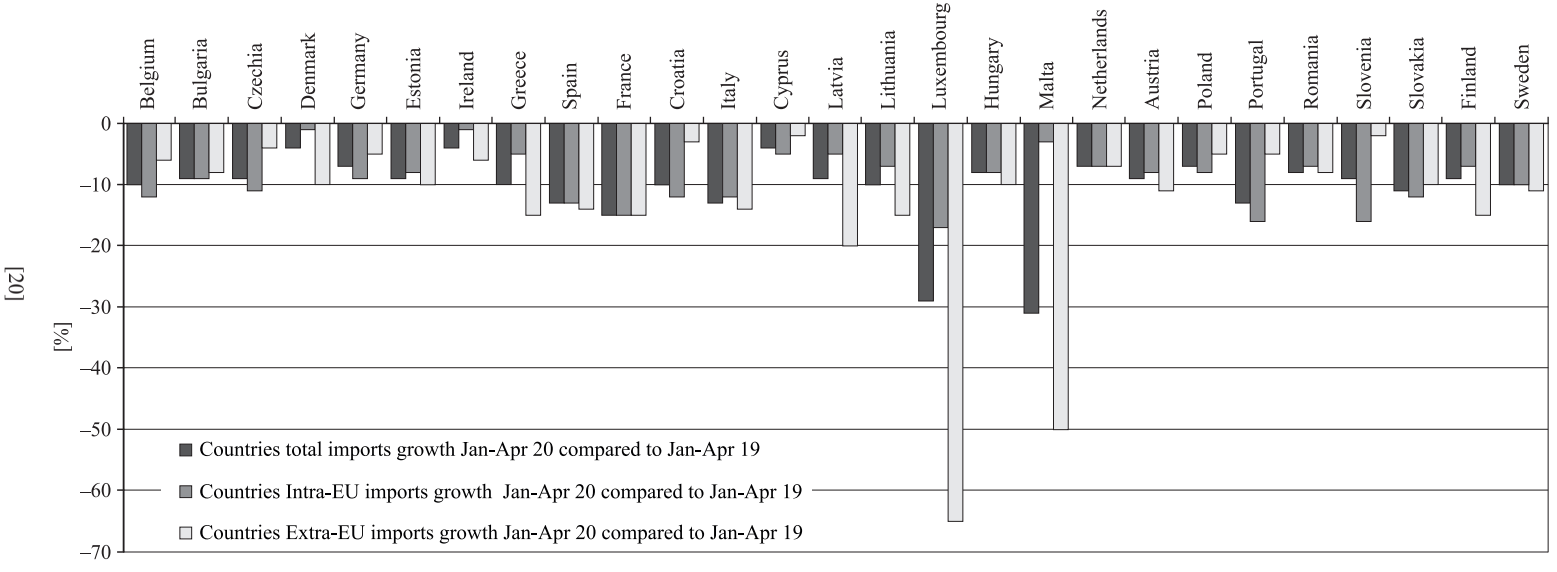
Country	Total imports	Intra-EU imports	Extra-EU imports
	growth January-April 2020 compared to January-April 2019		
Belgium	–10	–12	–6
Bulgaria	–9	–9	–8
Czechia	–9	–11	–4
Denmark	–4	–1	–10
Germany	–7	–9	–5
Estonia	–9	–8	–10
Ireland	–4	–1	–6
Greece	–10	–5	–15
Spain	–13	–13	–14
France	–15	–15	–15
Croatia	–10	–12	–3
Italy	–13	–12	–14
Cyprus	–4	–5	–2
Latvia	–9	–5	–20
Lithuania	–10	–7	–15
Luxembourg	–29	–17	–65
Hungary	–8	–8	–10
Malta	–31	–3	–50
Netherlands	–7	–7	–7
Austria	–9	–8	–11
Poland	–7	–8	–5
Portugal	–13	–16	–5
Romania	–8	–7	–8
Slovenia	–9	–16	–2
Slovakia	–11	–12	–10
Finland	–9	–7	–15
Sweden	–10	–10	–11

Source: based on *Eurostat news release euro indicators* 2020.

Of course, part of this fall can be explained by quarantine and physical limitations, because registering the car becomes much more complicated process under quaratine. But thisis only part of the explaination, because online-purcase and online-registration are available, with no requirement of physical presence.

Anyways these data and figures show extreme uncertainty and fears causing decrease in demand for new cars and triggering unavoidable reduction of future production.

Chart 3. EU imports change January-April 2020 compared to January-April 2019 (total, intra-EU and extra-EU)



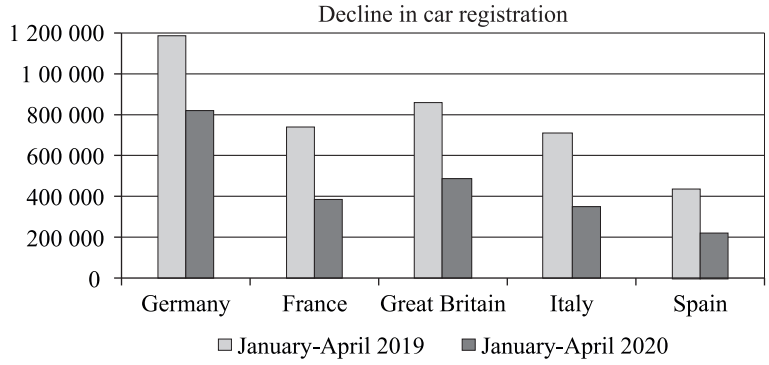
Source: based on *Eurostat news release euro indicators* 2020.

Table 4. New car registrations change January-April 2020 to January-April 2019

Country	January-April 2019	January-April 2020	Change [%]
Germany	1 190 807	822 202	–31.0
France	741 530	385 676	–48.0
Great Britain	862 100	487 878	–43.4
Italy	712 987	350 926	–50.8
Spain	436 317	222 870	–48.9

Source: *Marktanalyse: Neuzulassungen in der EU auf Rekordtief* 2020.

Chart 4. New car registrations change January-April 2020 to January-April 2019



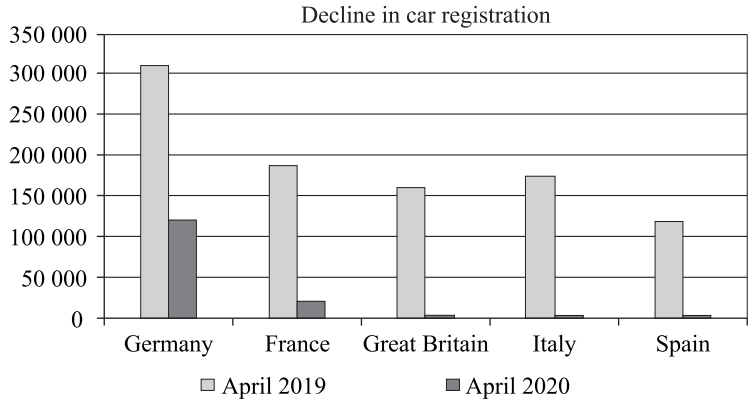
Source: based on Table 4.

Table 5. New car registrations change April 2020 to April 2019

Country	April 2019	April 2020	Change [%]
Germany	310 715	120 840	–61.1
France	188 195	20 997	–88.8
Great Britain	161 064	4 321	–97.3
Italy	174 922	4 279	–97.6
Spain	119 417	4 163	–96.5

Source: *Marktanalyse: Neuzulassungen in der EU auf Rekordtief* 2020.

Chart 5. New car registrations change April 2020 to April 2019



Source: based on Table 5.

In the same time we have to emphasise that we took automobile industry also because it has a very strong multiplier effect triggering increase or decrease in many other industries (steel, textile, electronics etc.), therefore any panics in the market in such industries will have long-term consequences upon the economy in general.

3. Minimizing of the COVID-19 outcomes for the European Union

The Coronavirus outbreak is a major shock for the European and global economy. For many countries, the COVID-19 crisis represents the first time since the war that citizens have been required to remain in their homes, and to restrict their travel and consumption. The economic impact of the pandemic is likely to be comparable to the shock of the 2008 financial crisis. Some say it will be considerably worse, and some even compare it to Great Depression.

The supply shock to the European and global economy resulting from the disruption of supply chains absences from the workplace, the demand shock to the European and global economy caused by lower consumer demand and the negative impact of uncertainty on investment plans, the impact of liquidity constraints for firms – these are not the only problems which affectconomy.

Member States have already adopted or are adopting budgetary, liquidity and policy measures to increase the capacity of their health systems and provide relief to those citizens and sectors that are particularly impacted [*Jobs and economy during the coronavirus pandemic* 2020].

During this crisis, EU countries are stepping up their efforts to support each other, helping those most in need and sharing resources to fight the spread of the virus. This is EU solidarity at its best. Since the outbreak of COVID-19, the EU has been working together with its member states to protect the health and well-being of EU citizens and save lives [*COVID-19 coronavirus pandemic* 2020].

In addition, the EU and its member states are taking resolute action to mitigate the socio-economic impact of the outbreak and sustain jobs. The EU is mobilizing resources to help member states coordinate their national responses, and this includes providing objective information about the spread of the virus and effective efforts to overcome it.

The EU has agreed on a coordinated temporary restriction on non-essential travel to the EU. Member States and non-EU Schengen countries have been invited to extend these temporary restrictions.

Violation of social life, impact on the EU economy, challenge for EU solidarity policy, temporary restriction on the tourism and others is bringing to the fore the question about research of COVID-19. Therefore this topic is relevant now and will create a basis for further research.

The quarantine regime was different on the territory of the European Union. Sweden, as one of the Scandinavian countries, has been the focus of global media attention and international criticism for its overly liberal strategy to combat the spread of COVID-19. This country tried to keep a certain balance between preventive measures against the spread of the virus and a normal life, nevertheless to ensure the save of democratic practice and liberty. The government did not impose strict restrictive measures or bans, penal systems and punishments for violating them, but limited itself of recommendations to citizens about personal hygiene. It is important to understand that the Swedish government continues to act strictly within its normal functions, as the country's legislation does not provide for any "emergency powers" in peacetime. The Swedish government does not have the ability to impose a "state of emergency" (in the country's Constitution, this concept applies only to wartime conditions). Swedish model of behaviour may look effective if we do not take into consideration low density of population (which can explain considerably low percentage) – but anyways now it becomes obvious that the absense of quarantine had some negative effects.

Much tougher measures have been taken in neighboring Denmark, Finland and Norway.

In other countries, such as Italy, France, Germany, Spain and Poland, the quarantine regime was also strict. The citizens were restricted in movement (sport activities, visiting of the libraries, museums, concerts, parks, regional travels), doing business (construction companies, retail trade, markets, enterprises, trade establishments, shops, malls, hotels, restaurants, bars, beauty salons, gyms, theaters), on the work of kindergartens, schools, universities and closed borders.

According to the report of the Organization for Economic Cooperation and Development, foreign direct investment flows in the time of COVID-19 are expected to fall by more than 30% in 2020 even under the most optimistic scenario for the success of the public health and economic support policy measures; to developing countries are expected to drop even more because sectors that have been severely impacted by the pandemic, including the primary and manufacturing sectors, account for a larger share of their FDI than in developed economies [*Foreign direct investment flows in the time of COVID-19*, 2020].

Many governments have taken stringent public health measures to limit the spread of the COVID-19 pandemic. These public health measures have caused severe economic disruptions that impact the foreign direct investment (FDI) decisions of companies. Governments have also taken significant economic policy actions to forestall, or cushion, the economic consequences of the public health crisis. The eventual impact on FDI flows will depend on the success of both these public health and economic policy responses.

In the longer term, the pandemic may lead companies to shift the geographic allocation of their foreign operation. For example, MNEs may review and potentially shorten their GVCs to protect themselves from supply-chain disruptions; alternatively, they could seek geographic diversification to reduce exposure to location-specific shocks and reduce costs to be able to deal better with crises [*Foreign direct investment flows in the time of COVID-19*, 2020].

The European Commission develops various funding programs to reduce the pandemic's consequences in the field of unemployment, business support and others. For instance, SURE program (Support mitigating Unemployment Risks in Emergency) – a new instrument to mitigate unemployment risks. The SURE initiative will provide financial assistance of up to €100 billion in total to Member States in the form of loans granted on favourable terms. These loans will help Member States to cover the costs of national short-time work schemes – public programmes that allow firms to reduce the working hours while providing income support. The Commission has allocated €8 billion to provide immediate financial relief to small and medium-sized businesses in the EU. The Commission has unlocked €1 billion from the European Fund for Strategic Investments to serve as guarantee to the European Investment Fund in incentivising local banks and other lenders to provide liquidity to at least 100,000 European small and medium enterprises. The European Commission is in close contact with national authorities, industry representatives and other stakeholders in order to monitor and evaluate the impact on European industries and trade. On 28 April, the European Commission adopted a banking package to help facilitate bank lending to households and businesses throughout the EU. This package ensures that banks can continue to lend money, thereby supporting the economy and significantly

mitigating the effects felt by citizens and businesses [*Jobs and economy during the coronavirus pandemic* 2020].

At a time of crisis caused with COVID-19 that has hit the world economy, EU countries and their governments are interfering in the process of overcoming the crisis, which is in line with Keynes's theory. (Generally speaking, Keynes's theory can be called "crisis" because, in essence, he considers the economy in a state of regular depressions) [Keynes 1936].

Germany's expenditure measures taken against the spread and impact of the coronavirus are related to the expansion of banking activities, establishment of an Economic Stabilization Fund targeting the real economy, direct grant programs for small business. Italy focused on the job protection measures: salary supplement; allocated EUR 10.3 billion to strengthen the social safety net, in particular temporary unemployment benefits for employees in every productive sector; paid parental leave who work in public authorities; financing of working migrants. The French government covers wages, facilitates working conditions, finances small and medium business, creates additional reserves in a state budget, pays benefits for civil servants, increases of the ceiling of the state guarantee on the refinancing of the unemployment insurance system. Poland issues insurance coverage for parents, wage subsidies, public guaranties, soft loans, state investments; increases liquidity and decreases the cost of money; exempts from social contributions. Spanish policy is based on unemployment benefits and self-employment.

The expenditure measures of the Scandinavian countries differed from others. For example, Denmark temporary compensates fixed costs of businesses, reimburses payments for illness to employers, takes the measures underpinning exports and investments (including guarantees), created National platform for crowdfunding, the Danish government has established a "Government and Business corona unit" in collaborations with relevant business organizations and labour market organisations to address sectoral economic distress. Sweden provides a temporary reduction of employers' social contributions, temporary discount for rental costs for firms in branches with considerable difficulties as a result of COVID-19, temporary relaxing unemployment insurance eligibility requirements, expansion of active labour market policies, measures to prevent COVID-19 fraud. The Finnish government decided to provide the subsidies for companies amount to EUR 1.8 billion and include EUR 1.2 billion of grants to enterprises provided via Business Finland (targeted at SMEs in most affected sectors). Other expenditure measures are similar to those was described above.

German employers can pay their employees subsidies and support up to an amount of EUR 1500 in 2020 tax-free or as wages in kind. In Italy was a suspension for 3 months of tax and social security payments in the municipalities most affected and suspension of VAT payments for firms and self-employed, an

additional tax credit for firms' capital uplifts. Exemption from income tax and social security contributions for overtime worked by employees; deferral of the payment of rents, electricity or gas bills for professional premises, VSEs and SMEs in sectors whose activity is interrupted; advanced refund of tax credits (including start-ups) was available in France. The Spanish government provides a possibility for SMEs and self-employed workers, upon request, to defer tax payments for six months, and benefit from interest rate subsidies. The Polish government provided a temporary postponement of payment deadlines of VAT. These measures were related to taxes.

As for the Scandinavian countries, Denmark organized an earlier payment of public procurement and earlier repayment of tax credits. Swedish SMEs can claim back the preliminary tax paid in 2019 and either pay it later or set it off against future losses [*Policy measures taken against the spread and impact of the coronavirus*, 2020].

As of today, almost all restrictive measures was lifted on the EU territory. Borders are open, citizens can attend all cultural events, restaurants or bars, libraries or museums. The workers are able to work if they didn't lose it during quarantine period. However, the economy has recovered, but when it will be return to the previous figures is a matter of time.

4. Conclusions

Minimizing of the COVID-19 outcomes for the European Union is a very difficult task, because it has to combine two different (and often opposite) goals:

1) To reduce activities and mobility as severely as possible to limit the further spreading of the virus to provide maximal safety and to save lives.

2) To stimulate demand, production and overall economic activity in order to avoid stagnation which would have heavy long-term economic impact because of strong multiplier effect to save economy.

It may seem that the priority of goal 1 in short run is much higher (according to Maslow's hierarchy) then the priority of goal 2.

But in longer run neglecting goal 2 can also lead to economic collapse which is non less dangerouse.

Therefore it becomes obvious that as long as reaching goal 2 using traditional economic models and methods endangers reaching goal 1, the structure and methods of doing business have to change.

There arises an obvious need to combine some form of quarantine (as strict as possible) with active encouraging of economic activities.

The only possible variant would be shifting to so-called Industry 4.0. Using freelance and outsoursing, improving supply chains and logistics, using miscelaneous just-in-time systems, "smart plants", automatization, robotization are the only way to save the economy without sacrificing human lives.

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Wpływ pandemii Covid-19 na gospodarkę europejską – pierwsze spojrzenie i perspektywy długoterminowe

Streszczenie. *W artykule przedstawiono wpływ pandemii COVID-19 na gospodarki krajów członkowskich UE. Analiza krótko- i długoterminowych skutków pandemii opiera się na danych dotyczących bilansu handlu wewnątrz i poza UE, importu i eksportu oraz uwzględnia możliwe przyszłe skutki, potencjalne efekty mnożnikowe, a także sposoby poprawy polityki gospodarczej pod kątem minimalizacji obecnych i długoterminowych zagrożeń dla gospodarki UE.*

Słowa kluczowe*: pandemia COVID-19, gospodarka europejska*

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Ukraine's industrial transformation models in the context of the EU experience

Abstract. *The article provides a comparative analysis of national policies related to Industry 4.0 (I4.0), taking into account their characteristics in terms of funding, focus, and direction. The authors also address obstacles to the successful implementation and enforcement of the I4.0 policy in the European countries as well as factors conducive to its successful implementation. Drawing on the analysis of the European experience of the digital transformation in industry and national economies in general, the authors highlight critical areas in need such transformations in Ukraine. The results of the study indicate that industrial transformation in Ukraine requires state support and cooperation between stakeholders involved in implementing Industry 4.0. According to the authors, it is necessary to create national and regional I4.0 platforms, following the example of EU countries, which would bring together government institutions, businesses, and academics.*

Keywords: *industry, manufacturing, industrial transformation, Industry 4.0, national policy I4.0, digitalization*

1. Introduction

At present, digital technologies are the basis for the so-called "fourth industrial revolution" with the potential for the qualitative transformation of EU industries and the creation of a basis for the significant growth of the European economy.

Industry 4.0 is a new level of control over the entire chain of creation value throughout the product lifecycle. When developing economic policy, it is important to pay attention to Industry 4.0, as it increases productivity, allows to produce new, better and individualized products, as well as implement new business models based on "undermining" innovations [Wang et al. 2017].

The McKinsey [Steden, Kirchne 2018] digital compass displays Industry 4.0 levers according to 8 key value-added factors, including the time to market (20-50%); reduction of maintenance costs (by 10-40%); productivity growth (by 3-5%); reduction of the machine's downtime (by 30-50%); increase in forecasting accuracy (by 85% or more); reduction of quality assurance costs (by 10-20%); reduction of storage costs (by 20-50%); increase in productivity of employees of technical professions through automation of knowledge-intensive work (by 45-55%).

Instead of creating new industries, the most significant opportunity for Europe is to transform existing industries and businesses. In response to such challenges, most EU governments have adopted I4.0 (Industry 4.0) policy as a priority to increase productivity and competitiveness, as well as to improve the high-tech skills of their workforce. In particular, such a policy is recognized as a priority in the national policies of Spain, Great Britain, France, Italy, Germany, the Czech Republic, Sweden, and the Netherlands [Ianenkova 2017].

The successful positioning of the Ukrainian modern industrial complex in the world markets depends on the high level of the interconnected system providing factors that characterize its development process. To substantiate a set of measures needed to transform Ukraine's industry based on European experience, it is vital to understand the degree of influence of a list of inhibiting factors on implementing the country's industry accelerated development. Among them are the imbalance of production and sales in Ukraine; the critical level of fixed assets depreciation and non-compliance with the rules and regulations on the use of depreciation fund and part of the profits for the renewal of fixed assets; the continuation of the production decline; loss of markets, especially in processing industries; a sharp decline in industrial financial and economic performance; deteriorating competitive ability and product quality; high material and energy intensity of production; the dominance of outdated approaches in technical policy; lack of an effective system of mechanisms and tools for innovation and investment development of the industrial complex; slow harmonization with international standards and others [*Nova industrializatsiia…* 2018].

Considering the mentioned above reasoning, Ukraine should intensify the use of the Industry 4.0 capabilities to not stay aside from the scientific and technological progress and gain additional benefits from implementing digital development strategies in the national economy.

Although I4.0 policies share a common goal, they still differ in design elements, funding approaches, and implementation strategies. As a result of comparative analysis, the authors of this article aim to identify critical areas of formation and development of the Ukrainian industry's digital transformation based on the analysis of European countries' experience.

2. Key characteristics of national policies of Industry 4.0

First of all, it should be noted that different countries emphasize different issues in their approaches to Industry 4.0 (Table 1).

Table 1. Approaches to Industry 4.0 in different countries – the comparison.

Country	Program	Driver	Current Focus
Germany	Industrie 4.0	Product Excellence	Engineering Excellence: Alignment of all components
China	Made in China – 2025	Resource Efficiency	Speed: build competence clusters and key technologies
USA	Industrial Internet	Vision	Disruptive innovations: digital radical software innovation
Japan	Industrial Value Chain Initiative	Demographic Changes	Scale: Enlarge pilot applications
Central-North EU	–	–	Similar to Germany
South EU	–	–	Re-industrialization
Ukraine	not defined by the state	not defined by the state	not defined by the state

Source: Steden, Kirchne 2018.

All Industry 4.0. policies are part of global strategy and are a priority in Europe. The broaden strategy contains a shared vision and approach to R&D, innovative, and industrial policies. The French L'industrie du Futur (IdF), for instance, related to the New Industrial France (NFI), while the Italian Intelligent Factory Cluster (CFI) is a part of the Italian innovation roadmap, which is a much broader strategy touching upon addressing global socio-economic challenges for Italy such as climate changes, scarce resources, demography developing issues, and others [*Key lessons from national industry 4.0 policy*, 2017].

France and the Netherlands have identified significant reasons for Industry 4.0 initiation as a lack of investments and compatible digital domains developing. In the Netherlands, a relatively low share of employment in the manufacturing sector has become the driving force to run Industry 4.0, which led to the need to create a large-scale IP industry. The German Industrie 4.0 has been started as one of ten future projects within the High-tech strategy plan 2020. In Spain's case, it was the digital part of the Procedure for Strengthening The Industrial Sector, which was gradually transformed into the so-called Industria Conectada 4.0 [*Key lessons from national industry 4.0 policy*, 2017].

Most of these policies aim to strengthen the country's industry, increase industrial competitiveness and upgrading, and better ensure the sustainable growth of the manufacturing sector. Typically, such economic goals are closely connected with social and environmental goals. Despite the common goals, policies show differences in the way how these economic goals should be achieved. In particular, most of the countries, including Germany, are focused on boosting productivity and achieving higher production efficiency. To ensure the next generation of technologies (Italy, UK), developing new products, and improving manufacturing processes (Germany, Italy), support for SMEs in innovation and commercialization aspects (UK, France, and Spain) can be identified, among other goals.

Also, industry 4.0 policies have their unique components despite common goals, giving each policy its characteristics. Thus, the French and Spanish initiatives are based on providing a market approach by giving loans to companies participating in the program. In Spain's case, the cost of a loan is covered depending on the approved strategy and company's type, and the coverage ranges from 25% to 70%. The French NFI combines a wide range of financial instruments, e.g., loans and fiscal incentives, and R&D investments [*Key lessons from national industry 4.0 policy*, 2017].

Peculiarities analysis of national I4.0 allows to identify the relevant EU countries' policies' main cornerstones. After looking over the financial component it was found out that most European national policies I4.0 are primarily state-financed with partial co-financing from the private sector. When considering the main focus or I4.0 policy object, they primarily orient on technology and infrastructure but give a secondary role to the professional skills development. A notable exception is Sweden, which pays special attention to the evolvement of highly qualified personnel under the Produktion 2030 Program, focused on developing the National Higher School of Manufacturing. In addition to Sweden, Průmysl 4.0 in the Czech Republic is also oriented on manufacturing skills, including technical skills.

In terms of governance and policy implementation, most national policies I4.0 took a top-down approach to design, initiating, and implementing initiatives. While stakeholders are consulted and play a role in implementing relevant national policies, the governments are in charge. Sweden is a notable exception again, that defines the Produktion 2030 Program by industry, academia, and research groups sharing responsibility for the initiative's design and operation. However, the private industry mainly provides funding. The Dutch smart industry (SI) is another exception. SI is based on the triple principle of a bottom-up spiral with industry, universities, research institutions, and the public sector in determining the directions and the primary focus of policy.

Cooperation between representatives of public structures, scientific and private institutions, is the main driving force among the considered national

policies I4.0, while for the majority such cooperation consists of joint work between representatives of different spheres and power verticals [*Accelerating the digital transformation* 2016]. The British policy I4.0 – HVMC contains an effective mechanism to promote cross-center cooperation: cross-center forums of Catapult. In these forums, representatives from all centers work together to identify technological challenges and opportunities formed collectively by HVMC centers. Apart from that, there is a particular budget aimed to support cross-central technology projects. In general, representatives from various fields and stakeholders' participation is a defining force of national policies I4.0 The cooperation of actors from different industries/stakeholders is prevalently cited as a driving force of policy.

In some cases, the manufacturing industry actively encourages such initiatives: the Netherlands and France are an excellent illustration of how the main impetus for policy development I4.0 comes from industry. Regional authorities' involvement in adopting the I4.0 strategy at the regional level – often as reasonable strategy specialization – is regularly encouraged and occurred in EU countries to better coordinate policies between the national and regional levels. Public authorities' initiative to promote I4.0 policy remains essential, mainly when industries operate separately or are fragmented enough to reach consensus among industry actors. An example is Industrie 4.0 in Germany, which shows how the large I4.0 platform can reduce industry segregation and improve the industrial network.

3. Constraint to successful implementation of I4.0 policy in European countries

After analyzing the obstacles and barriers to the successful implementation and enforcement of the I4.0 policy, it was concluded that there is no specific barrier that stands out as a common denominator for EU I4.0 national policies. Instead of it, there are different aspects, which are specific for different countries. The most common factors that challenge the initiatives' implementation are limited resources and insufficient involvement of SMEs. Like any other large-scale strategic project, initial public funding is crucial for the I4.0 policy to increase the speed and efficiency of its implementation and increase the capacity needed for effective program operations. For example, in the Netherlands, the reduction in resources adds significant doubts as to whether the program office of seven part-time employees is sufficient to influence the initiative's ambitious goals effectively.

Weaknesses in the British HVMC have been successfully addressed through the UK government's effective response to the need for increased funding. Besides, SMEs' significant involvement has been a challenge for both HVMC and P2030 in Sweden. In response to this challenge, the UK runs a particular program to attract SMEs – HVM REACH, which was created within the HVMC. In Sweden, experience has shown that while large companies are often familiar with obtaining financing, SMEs need more support in applying for financing [*Key lessons from national industry 4.0 policy*, 2017].

The results of the SWOT analysis of national initiatives I4.0 indicate a low degree of convergence. The main weaknesses identified in the analysis are the following barriers: limited funding, lack of capacity, weak planning, and monitoring of existing mechanisms, challenges for involving SMEs in programs. In France, they express doubts regarding the possibility to reliably measure the policy's achievements. Spain, in its turn, currently lacks a clear definition of I4.0 policy objectives and milestones. The answer to these challenges in most EU countries (the so-called strengths identified as a result of the SWOT analysis) is the support of companies, coordination of various management policies, and co-financing of industries.

Meanwhile, I4.0 policy opportunities mainly reflect the potential for scalability and transferring/borrowing and new market and international collaboration opportunities. Thus, in Sweden, the potential for scaling up the Higher School of Manufacturing in the Nordic region opens up new policy opportunities. Italy is expanding its funding and diversification of Industry 4.0 financial support instruments, opening up new industrial companies' opportunities.

Analysis of threats allowed to highlight the insufficient scale of policies in some countries and the imbalance between the interests of different government and industry levels. The model of balanced financing is important to ensure the right balance between encouraging risky initiatives and stimulating innovation in industries that benefit from the implementation of Industry 4.0.

The French IdF took into account the lessons learned during the previous NFI industrial development policy implementation. First of all, it resulted in the network structure of the IdFA platform in the policy design – the involvement of industry, research and technology companies, as well as trade union representatives, that has become the key to the success of this policy. Existing technological gaps have been filled out by firms working in the field of the latest digital technologies.

The Swedish government has developed a bottom-up model concept, driven nearly by industry stakeholders and research institutions. In Germany, the main lessons learned from the implementation of the I4.0 policy include the expansion of the network and the development of shared norms and standards for network members' functioning and interaction to reduce competition. The second lesson

included justifying the need to provide targeted funding instruments and mechanisms to increase SMEs' involvement. Targeted approaches to engaging SMEs also included specialized support for SME integration in I4.0 and global value chains. SMEs are often less prepared for technological progress due to a lack of relevant professionals or a lack of experience with the latest technologies.

The regional focus and emphasis on cooperation with development laboratories provided exciting prospects for the Netherlands. Direct close cooperation between companies and research structures and laboratories in different regions has facilitated access to relevant knowledge and contributed to the technological progress of manufacturing companies.

The experience that can be borrowed from the Italian CFI relates to the strategic role of clusters in determining industrial policy. Since industrial policy in Europe is very fragmented compared to the United States or China, a specialized cluster can be instrumental to inform industrial policy makers about the need to implement specific technologies.

4. Factors for successful implementation of I4.0 policy in EU countries

It should be noted that the main driving force of the EU countries is cooperation. It cannot be said that "it all depends on the government" or big brands. Other actors, such as industry, developers, research institutions, universities, startups, and others, are sufficiently proactive and mobilized in the EU to address Industry 4.0 challenges and work together.

In general, after summarizing the experience of implementing I4.0 policy in many EU countries, the following success factors for policy implementation were defined: approval by governments of national industrial development programs 4.0; setting clear goals with measurement results; setting stages and key achievements targets measured by qualitative and quantitative indicators, as well as rigorous monitoring and clearly established evaluation mechanisms; private co-financing of policy I4.0 – a higher degree of co-financing by industrial entities provides greater efficiency of initiatives and sustainability of industrial business; providing broader powers to industry; attracting more innovative and market-friendly financing instruments, such as business loans and tax benefits; a more specialized approach to effectively involve SMEs, for example by providing specialized financing instruments; speed of project implementation; creation large multilateral platforms, which consider initiatives aimed at increasing the technological potential and implementation of programs for digital transformation of the industrial companies needs.

5. Key highlights of the Ukrainian industrial transformation in the context of the EU experience

According to McKinsey's forecast [Steden, Kirchne 2018], the industrial Internet introduction's total economic effect will reach up to 11 trillion US dollars per year by 2025. Accordingly, companies that are actively involved in the Fourth Industrial Revolution today will gain significant competitive advantages. Another consulting company, Roland Berger, estimates that the EU economy will receive up to 1.25 trillion US dollars in profits in the upcoming years if policy I4.0 is successfully implemented [Berger 2016].

Therefore, Ukraine needs to move towards Industry 4.0 not to lose competitive advantages and not lag behind the global pace of technological development for years. Certain steps in this direction have already been taken. In particular, the Industry 4.0 movement in Ukraine has been established. APPA (Association of Industrial Automation Enterprises of Ukraine) pays great attention to creating a theoretical and practical basis for implementing the I4.0 policy in Ukraine. Since June 2019, the Industry4Ukraine platform has been created, including more than 40 business and industrial associations.

Considering the Ukrainian strategic course for cooperation (in the future – integration) with the EU and foreign experience in developing the smart industry in determining the most effective approaches and practices, it is expedient to take into account institutional features that affect the final application. Among them are the ratio of inclusive (that facilitate innovative development path), extractive, and informal institutions that can create barriers and reduce the degree of motivation to innovation.

If to consider the experience of Ukraine's closest neighbors, four significant differences from Ukraine can be identified:

1. They all have the Ministry of Industry responsible for government industrial development programs, including numerous incentives for investors, businesses themselves, and innovators.

2. In most Eastern European countries, there are state programs of industry 4.0. For example, such programs are Poland, the Czech Republic, Lithuania, Latvia, Slovakia, Hungary, and other countries. According to the index of regulatory efficiency, the World Economic Forum (WEF) annually monitors the state of countries' readiness to I4.0, rates Ukraine the 99th out of 100 countries. The Ukrainian government is very weak, unable to regulate numerical imbalances, which can be seen both externally and internally [Kniaziev 2020].

3. These programs are based on existing general industrial, export-integrative (EU), innovative, and cluster development programs. There are no such existing programs in Ukraine.

4. The implementation of these general industrial and innovative digital policies is already yielding results.

When implementing a specific European smart strategy in Ukraine, it is expedient to acknowledge the mentality's compatibility and the quality of the donor and acceptor countries' institutional environment. While taking the concept of basic (mother) types of national innovation systems, it is important to target the common with Ukraine's basic national innovation systems. In particular, these include Poland, Portugal, Slovakia, Hungary, the Czech Republic, and others. Also, it is necessary to take into account the size and structure of the Ukrainian economy: the share of manufacturing in GDP, the level of small and medium-sized businesses development, financial reserves and liabilities of the state budget, investment climate, and other parameters. For example, the processing industry's share in Ukraine's total GDP in 2018 and 2019 was 11.65% and 10.8%, respectively. Considering these data, it is advisable to focus on smart readiness leaders or so-called "traditionalists" with a high share of manufacturing in GDP, i.e., Germany, Ireland, and the Czech Republic, when choosing paragon countries positive foreign experience analysis in the development of the smart industry [Kniaziev 2020].

Thus, when choosing the best practices for the development of the smart industry in Ukraine, it is necessary to take into account not only macroeconomic indicators but also the degree of difference (proximity) of its institutional environment to countries of standards. Furthermore, it is advisable to consider the results of the mid-term evaluation of progress and key lessons learned from the implementation of smart strategies, obtained experimentally and inherent in all European industrial policies in general. The effectiveness of the practical implementation of the planned smart initiatives will depend on:

– the speed of project implementation, which affects the accumulation of "critical mass" of qualitative changes (it is difficult to achieve this "critical mass" with unstable funding and low speed of implementation);

– establishment of clear and quantifiable goals (indicative planning with control points–indicators), as well as the availability of effective mechanisms for monitoring and evaluating the effectiveness of innovative projects;

– the scale of economic tools use to motivate investment in smart development;

– investment activity of business (to balance public investment) and other.

Currently, there are no valid strategic documents that would define approaches to industrial policy in Ukraine. In April 2018, the government published for discussion a draft Strategy for the Industrial Complex Development in Ukraine by 2025, but it has not been adopted yet [Ministry for Development of Economy, Trade and Agriculture of Ukraine]. The draft Strategy provided only a few measures to support the development of Industry 4.0 [Anhel, Kravchuk 2019]:

– infrastructure audit;
– popularization and advancement of technologies;
– introduction of international standards into the field of industrial production;
– attracting funding for the Horizon 2020 program;
– support for educational activities and development of a list of new professions.

The draft Strategy also identified several general measures that are key to both the industry's development as a whole and Industry 4.0. These measures relate primarily to creating clusters, stimulating innovation, start-up specialization, etc. This approach is broadly in line with the situation in many other countries, where the development of Industry 4.0 is complementary to industrial and innovation policies. However, the draft lacks measures to establish better stakeholder dialogue and financial support tools (benefits, loans, etc.).

Taking into account the information provided above, a list of measures can be defined for industrial development and implementation of Industry 4.0 in Ukraine, that addresses a number of the following issues:

1. The priority task is to complete the work on formulating the government's industrial policy. That can be done by adopting the Industrial Development Strategy or other documents to formulate the government's position on industrial policy. Other government policy documents (current and draft) should be aligned with this concept of state policy.

2. State industrial policy should focus on improving the rules of the game of the industry and the economy at large. That is a standard set of reforms, such as the struggle against corruption, judicial reform, modernization of the education system, development of the financial sector, improving the investment climate by reducing the regulatory burden on business, and implementing transparent and equal rules of the game.

3. The main initiative should derive from the industrial representatives with the support of the state. It is necessary to create a national and regional 4.0 platform, following EU countries' example, which would unite state institutions, businesses, and scientists. The national movement "Industry 4.0 in Ukraine" has already started this movement [Fedak 2020].

4. Given the limited budget funding, it is necessary to refrain from introducing large new state aid programs for industrial enterprises in tax benefits or direct subsidies. Instead, it is urgent to analyze the effect of existing benefits and draw conclusions about their feasibility. Suppose there is a positive effect of state aid on industrial development. In that case, aid should be provided under the following principles: it should be received on time, for a certain period and in a targeted manner.

5. State aid to economic entities must comply with international obligations: it must not distort competition and foreign trade conditions.

6. Work on expanding funding sources for innovative projects in the industry is needed. Today, the existing preferential funding mechanisms (for example, under the Horizon 2020 program) are insufficiently used, so it is worth analyzing possible bottlenecks in the process.

7. It is necessary to support the creation of new enterprises and the technological renewal of industrial SMEs. This area can be promising for attracting donor and public funds, such as conducting technological audits of SMEs and supporting startups. However, the ultimate responsibility for increasing the productivity of their production rests with the entrepreneurs themselves.

8. Education, science, and industrial policy – the development of industry in general and innovation require a thorough overhaul of the education system in Ukraine. Technical universities should become an integral part of our country's innovation sector with close ties to industrial enterprises. The reform of profes-

Table 2. General approaches to Industry 4.0 in economic policy

Policy sector	Industrial policy example
Incentives for investments related to Industry 4.0	Loan subsidies Grants
Technological policy/ technology transfer	Joint research projects Transfer Center or Network Industry 4.0 for superior support for SMEs Innovative vouchers Promoting the development of industrial startups
Opportunities to obtain information and establish business contacts	Enabling large multinational corporations, SMEs, and artisans to use artificial intelligence and Industry 4.0. Demonstration projects and demonstration production lines Websites similar to the German "Plattform Industrie 4.0."
Education and training	Promoting the study of media-related competencies in schools Strengthening professional technical training Use of test and competence centers for training and qualification
Consultation services	Self-assessment tools, checklists Subsidizing coaching services and counseling for career guidance
Economic development	Promoting cooperation within the country and international cooperation Attracting foreign direct investment and developing entrepreneurship with a clear focus on manufacturing and the most promising sectors: the fDI Markets newsletter (12/04/2018) names agriculture, logistics, banking, healthcare, and real estate investment as such sectors for Ukraine. Revitalization of the SME sector Development of clusters and networks. Example: the technology network "It's OWL" (OstWestfalenLippe) with 200 participants. (http://www.its-owl.de)

Source: Steden, Kirchne 2018.

sional technical education is essential. It should be designed to train qualified personnel for industrial enterprises (whereas now there is a significant gap between the skills acquired by professional technical school graduates and those needed by employers).

Despite the lack of state support and appropriate conditions for development, Ukrainian business invests in education in the area of I4.0, develops national strategies, and partially implements them, supports laboratories of higher education institutions, harmonizes national standards, creates technology parks and incubators, and tries to combine industry with science. That demonstrates Ukraine has sufficient potential to take one of the leading countries among the new economic development concepts. In particular, that requires the constant interaction of public authorities, industrial enterprises, IT companies, universities, scientific innovation centers (technology parks), research centers, and other sides. The state should create a legal framework and make initial investments related to Industry 4.0 in industrial production and IT companies, which, together with the state, should continuously financially support the training of industry-relevant specialists in various fields [Ianenkova 2017]. There should be constant cooperation between specialists and scientists, the exchange of innovations, etc. between business and education and science.

It is especially important for Ukraine to consider the approaches of Industry 4.0. in its economic policy (Table 2).

6. Conclusions

Industry 4.0 is the industrial production of the future that is already happening today. Therefore, Ukraine needs to be actively involved in global processes related to the new trend of economic development to take a worthy place among the developed countries of the world.

All in all, mostly foreign companies, small and medium-sized businesses, most of which are united in APPAU, invest in promoting Industry 4.0 and innovative ecosystems in Ukraine today. Industrialists, infrastructure operators, and the state are quite passive. This behavior is strikingly different from European and global trends. It is large national corporations and the state that become the main investors in developing Industry 4.0 of their countries.

The analysis of EU experience allowed us to make several observations that are important in the context of planning further state support of Industry 4.0 in Ukraine:

– programs (measures) are usually included in broader strategic documents (development 4.0 is a part of industrial policy in Germany, France, and Hungary);

– the focus of programs is mainly independent of specific sectors or areas, although usually, the main beneficiaries are companies with a high level of technological production;

– emphasis on the development of cooperation between stakeholders. For example, in Germany and Austria, Industry 4.0 platforms have been launched, bringing together public authorities, research institutions, and businesses;

Initiatives involve both public and private sources of funding.

Further research can be aimed at developing a set of measures to support the Ukrainian industry's transformation and the development of national policy I4.0.

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Modele transformacji przemysłu Ukrainy w kontekście doświadczeń UE

Streszczenie. *Artykuł przedstawia analizę porównawczą krajowych strategii dotyczących Przemysłu 4.0 (I4.0) z uwzględnieniem ich charakterystyki w zakresie finansowania i ukierunkowania. Autorki zwracają uwagę zarówno na przeszkody utrudniające skuteczne wdrażanie i egzekwowanie polityki I4.0 w krajach europejskich, jak i na czynniki sprzyjające jej pomyślnej realizacji. Opierając się na analizie europejskich doświadczeń związanych z transformacją cyfrową w przemyśle i ogólnie w gospodarkach narodowych, omawiają krytyczne obszary wymagające takich przekształceń na Ukrainie. Wyniki badania wskazują, że transformacja przemysłu ukraińskiego wymaga wsparcia państwa i współpracy między interesariuszami zaangażowanymi we wdrażanie koncepcji Przemysłu 4.0. Zdaniem autorek konieczne jest tworzenie ogólnokrajowych i regionalnych platform I4.0 na wzór krajów UE, które skupiałyby instytucje rządowe, biznes i naukowców.*

Słowa kluczowe*: przemysł, produkcja, transformacja przemysłowa, Przemysł 4.0, polityka państwa I4.0, cyfryzacja*

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A comparative assessment of intersectoral relations of the woodworking industry: Ukraine, Poland, Germany

Abstract. *The authors identify the key problems and characteristics of the development of the woodworking industry by comparing the closeness of intersectoral ties and the cost of woodworking production in Ukraine and EU member states, including Poland and Germany. The results of the analysis indicate that the consumption of wood products by the Ukrainian economy is smaller by a factor of six compared to the Polish economy and by a factor of 20 compared with the German economy. It also turns out that the cost of Ukrainian woodworking production is the highest of all EU countries. The authors argue that the decreasing level of processing of raw material and the deteriorating manufacturability require a structural transformation of the Ukrainian wood processing industry.*

Keywords: *woodworking industry, intersectoral relations, intermediate consumption, production, consumption*

1. Formulation of the problem

Today, the woodworking industry is a strategically promising export-oriented segment of the world economy, as well as an important link in the formation of global value chains. The objective basis for the further dynamic development of woodworking industries in Ukraine is created by the presence of a significant raw material base and prospects for expanding markets (both domestic and foreign). Proof of this is the 6-th place of Ukraine among the EU countries in terms of timber reserves and 7-th – in terms of liquid wood harvesting. Ukraine is also

ranked 27-th among the world's largest exporters of wood products. However, the available potential is far from being fully used, primarily due to the lack of a strategic vision for the development of the Ukrainian woodworking industry.

The efficiency and prospects of woodworking industries depend on the processes of forestry development, the level of technology and conditions of the furniture industry, as well as the demand for wood products from other economic activities (especially construction), the closeness of intersectoral links of the woodworking industry. The assessment of intersectoral relations is carried out according to the tables "cost-output", which are also called matrices of the intersectoral balance of Leontief. The relevance and importance of such an assessment for Ukraine is due to the need to determine the degree of correspondence between supply and demand for wood products in the domestic market.

2. Literature review

The work of many scientists and practitioners is devoted to solving the main problems of the functioning of the forest and woodworking sectors in modern conditions. Thus, the peculiarities of the functioning of the woodworking industry of Ukraine in terms of economic integration are considered in [Heyets, Ostashko (eds.) 2016]. Trends in foreign trade in wood products in Ukraine and EU countries were studied in [Sozanskyy, Koval 2019], and key aspects of the formation and implementation of raw materials for Ukrainian wood production at the regional level are covered in [Ishchuk, Sozanskyy 2019].

Some theoretical and analytical aspects of the formation of intersectoral links in the woodworking industry are given in [Wanat et al. 2018; Ramage et al. 2017; Geršak, Muhaj 2016]. In particular [Wanat et al. 2018] examines the mechanisms of cooperation between local governments and businesses operating in the forestry and woodworking industry of Poland. Technological interrelations of the woodworking industry with the construction sector and chemical industries, global trends and chains of use and harvesting of wood are described in [Ramage et al. 2017]. In [Geršak, Muhaj 2016], on the basis of these tables "cost-output" an assessment of structural changes in the Slovenian economy. However, in these and other applied and fundamental studies, insufficient attention is paid to the issues of vertical-horizontal analysis of intersectoral economic relations of the woodworking industry.

The **purpose of the article** is to identify problems and prospects for the development of the woodworking industry of Ukraine based on the results of the assessment of its intersectoral ties, in particular in comparison with Poland and Germany.

3. Main results of the study

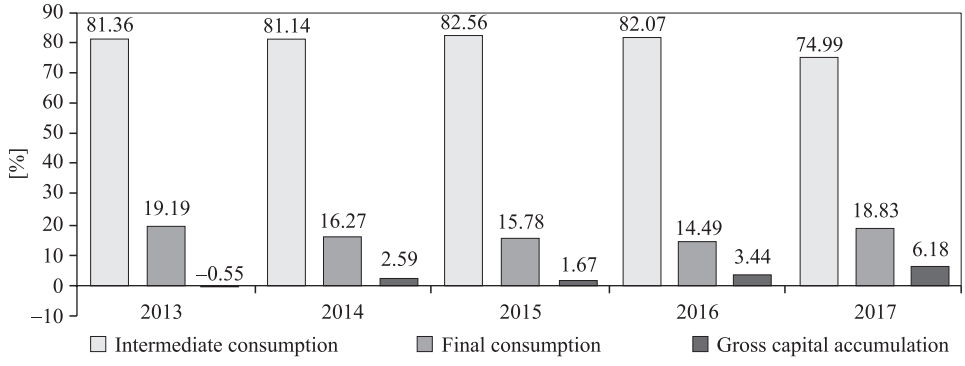
In 2017, Ukraine produced woodworking products worth 128,689 bill. UAH (in consumer prices) or 42 890 bill. euros, which is 5.1 in times less than in Poland in this period [SSSU 2017], [National accounts aggregates by industry 2017]. In terms of wood production, Ukraine is 21.3 in times behind the leader among the countries of the European Union (EU) – Germany, and the nearest geographical neighbors, in particular, Romania 1.4 in times, the Czech Republic – 2.0, Poland – 5.

The structure of woodworking products in Ukraine in terms of its use is steadily dominated by products for production purposes or intermediate consumption (Chart 1). However, in 2017 the share of these products in this structure decreased significantly (by 7.08 percentage points – pp.) compared to 2016, while the share of final consumption products (by 4.34 pp.) and gross accumulation increased capital (by 2.74 pp.).

In 2017, the economy of Ukraine consumed the production resources of the woodworking industry by 92 814 bill. UAH, which is 4.71% more than in 2016 and 85.34% more than in 2013 [SSSU 2017]. However, this increase is due to the devaluation of the national currency, as in dollar terms, this figure increased by only 0.6% in 2017 (vs. 7.1% in 2016) (Chart 2) wood products by the Ukrainian economy in 2017.

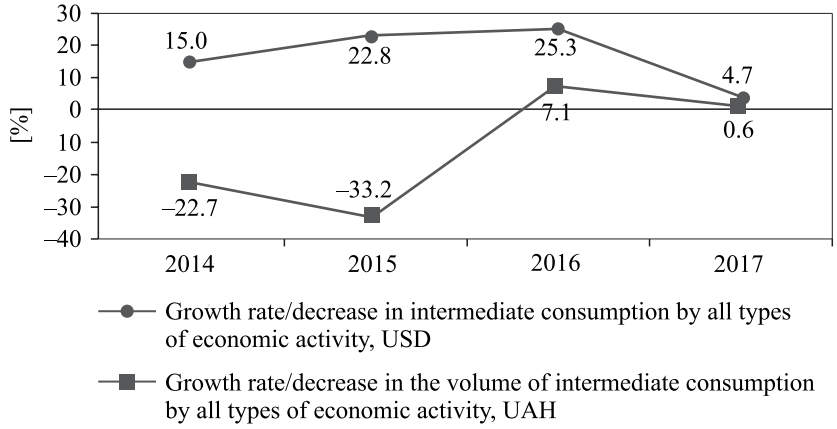
Compared to those EU countries where the woodworking industry is well developed, the Ukrainian economy consumes much less woodworking products for industrial purposes. Thus, in terms of the use of intermediate wood products in 2015, the Ukrainian economy was 5.8 in times inferior to the Polish economy,

Chart 1. The structure of wood products of Ukraine by areas of its use



Source: calculated according to SSSU 2017.

Chart 2. Dynamics of use of woodworking products of intermediate consumption in Ukraine



Source: calculated according to SSSU 2017.

and the German economy was 21.2 in times inferior [SSSU 2017], [National accounts aggregates by industry 2017].

In the structure of intermediate consumption of all types of economic activity of Ukraine, woodworking products in 2017 accounted for 2.1%. The largest consumers of these products are the woodworking industry (production of wood, paper; printing and replication), as well as food (food production, beverages and tobacco products) industry. Thus, in 2017, the woodworking industry accounted for 30.52% (or 28 331 bill. UAH) of intermediate wood processing products against 33.19% (29 422 bill. UAH) in 2016 (Table 1). In terms of this indicator, Ukraine is close to Poland (> 32%) and Germany (> 29%).

However, in terms of consumption by the woodworking industry of its own production products, Ukraine is 5.9 in times inferior to Poland and more than 19 in times inferior to Germany. Given the approximately equal supply of wood in Ukraine and Poland, such a discrepancy is a sign of incomplete use of raw material potential by the domestic woodworking industry.

The second largest consumer of intermediate wood products in Ukraine is the food industry (or food production; beverages and tobacco products). The share of the food industry in the volume of intermediate wood products consumed by the economy in 2017 was 25.17% (vs. 26.24% in 2013). The importance of this foreign trade in the structure of wood processing products of intermediate consumption in Ukraine is very high. For example, in Poland, the food industry accounts for about 6% of intermediate wood products, and in Germany – about 2.5%. At the same time, in terms of consumption of woodworking products, the Ukrainian food industry is 1.3 in times inferior to the Polish one, and almost

Table 1. Shares of the largest consumers of wood products in Ukraine (in the segment of intermediate consumption), in [%]

NACE activities	2013	2014	2015	2016	2017	Deviation (+/–)			
						2014-2013	2015-2014	2016-2015	2017-2016
Manufacture of wood, paper, printing and reproduction	30.65	30.06	31.86	33.19	30.52	–0.59	1.81	1.33	–2.67
Manufacture of food products; beverages and tobacco products	26.24	27.89	27.15	25.50	25.17	1.65	–0.74	–1.65	–0.33
Wholesale and retail trade; repair of motor vehicles and motorcycles	9.84	7.79	5.83	6.75	10.04	–2.05	–1.96	0.91	3.30
Public administration and defense; compulsory social insurance	2.64	6.00	8.35	7.28	5.89	3.35	2.35	–1.07	–1.39
Construction	2.80	2.56	2.06	1.97	4.47	–0.24	–0.50	–0.09	2.50
Manufacture of wood, paper, printing and reproduction	3.69	3.00	2.05	2.71	3.15	–0.69	–0.95	0.66	0.44
Manufacture of furniture; other products; repair and installation of machines and equipment	3.55	2.77	2.78	2.92	2.27	–0.78	0.01	0.14	–0.65

Source: calculated according to SSSU 2017.

twice in times lower than the German one. The main products of woodworking industries used in the food industry are a wide range of cardboard and paper products. In particular, in 2017, the domestic food industry used wood products by 23 360 bill. UAH, which is 3.35% more than in 2016 and 77.78% more than in 2013.

The third largest consumer of wood products in Ukraine is wholesale and retail trade. The share of this foreign trade in the structure of intermediate consumption of wood products was variable: it decreased in 2014-2015 to 5.83%, but increased in 2016-2017 to 10.04%. The weight of the trade sector of the economy in the structure of intermediate consumption of wood products in Poland and Germany is lower – 7.37% and 5.25%, but consumption is significantly higher: 7.38 in times and 19.04 in times, respectively.

In 2017, the trade sector in Ukraine consumed wood products worth 9319 bill. UAH or 390 38 bill. USD. The growth rate of consumption of wood products by this foreign economic activity in the UAH equivalent in 2017 reached 55.86% vs. (–8.95% in 2014), and in the USD – 49.74% vs. 38.77%, respectively. Vertical relationship between woodworking industry and wholesale and retail trade is manifested mainly in the sale through the retail network of wood products for consumer purposes. Therefore, the growth of consumption of wood products by the trade sector is a sign of increased sales of wood products of final

consumption in Ukraine, which confirmed the changes (increase in the share of final consumption by 4.34 percentage points) in the structure of wood products in Ukraine by use in 2017 (Chart 1).

In addition to the woodworking and food industries, the main consumers of woodworking products in Ukraine include public administration and defense; compulsory social insurance, the share of which in the structure of intermediate consumption of wood products in 2015 reached 8.35%, but in 2017 decreased to 5.89%. In Poland and Germany, the value of this indicator was significantly lower – 1.0% and 2.98%, respectively.

In 2017, the state administration and defense in Ukraine consumed woodworking products worth 5465 bill. UAH, which is 4.1 in times more than in 2013, but 15.3 in times less than in 2016. At the same time, the volume of consumption of wood processing products in Ukraine in 2015 in Ukraine was 1.4 in times higher than in Poland. One of the key reasons for the increase in the consumption of wood products for industrial use by public administration and defense in 2015-2016 was the growing needs of the Ukrainian army for such products, although this volume was 7.6 in times lower than in Germany.

Construction is one of the largest consumers of wood products in the EU, but not in Ukraine. Thus, in 2015, construction in Poland consumed 10.81% of woodworking production, and in Germany – 8.55%. In Ukraine, from the other hand, in 2017 the construction sector of the economy accounted for 4.47% of woodworking products, while in 2015 – only 2.06%. The volume of consumption by domestic construction of woodworking products in 2017 amounted to 4149 bill. UAH, which is 138.04% more than in 2016 and 195.11% more than in 2013 (in UAH equivalent). In USD terms, this difference was (+ 128.68%) and (–11.19%), respectively. Consumption of wood products by the construction sector of the Polish economy was more than 30 in times higher (data for 2015), and Germany – almost 88 in times.

One of the largest consumers of woodworking products in countries with developed woodworking industries is also the production of furniture; other products; repair and installation of machines and equipment. In particular, in Poland this foreign trade accounts for about 8%, and in Germany – about 6% of intermediate wood products, while in Ukraine – only 2.3% (in 2017). During 2013-2017, the share of the domestic furniture industry in the structure of consumption of woodworking products decreased by 1.28 pp. In addition, in terms of consumption of these products, the Ukrainian furniture industry in 2015 was 14.7 in times lower than the Polish and 41.9 in times lower than the German.

A significant consumer (with a share of »8% in the structure of intermediate consumption) of wood products for industrial purposes in Germany (but much smaller in Poland and Ukraine) is publishing; production of movies and videos, television programs, publication of sound recordings; activity of radio broadcast-

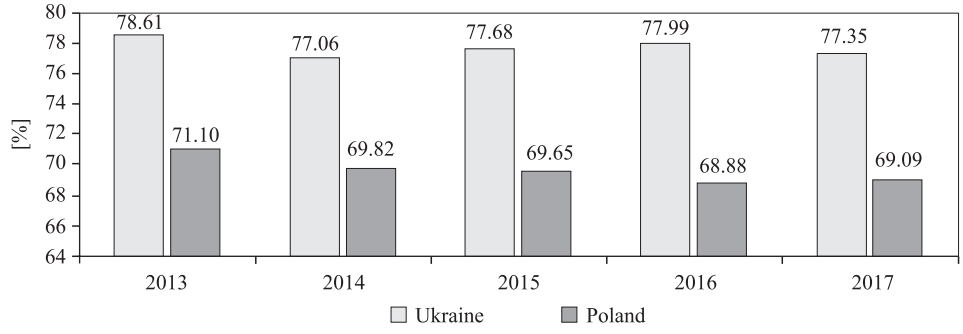
ing (and television broadcasting (hereinafter – publishing activity). In 2017, this figure in Ukraine was 3.15% (vs. 3.69% in 2013). The volume of consumption of wood products in publishing activities in 2017, compared to 2015, it increased by 7.43% (or 146 bill. UAH), however, according to this indicator, the Ukrainian publishing activity is inferior to the Polish one more than 7 in times, and the German one – almost 60 in times.

In addition to deepening the level of untapped potential of woodworking industries in the segment of providing woodworking products of intermediate consumption of the furniture industry and the construction sector, in Ukraine there is an acute problem of cost of these industries. An indicator of the cost of a particular industrial production is an indicator of the share of intermediate consumption (goods and services) in output. In Ukraine during 2013-2017, the level of consumption of woodworking industries was consistently high (»78%) (Chart 3).

The share of costs in the production of wood products in Ukraine in 2017 was 8.25 pp. higher than in Poland, while in 2012 – by 7.51 pp. The level of consumption of domestic wood products is almost the highest among the EU countries (after Greece) (calculated according to SSSU 2017, National accounts aggregates by industry 2017). In particular, in Germany it is lower by 10 pp., and in Lithuania by 20 pp.

Expenditures (intermediate consumption) of the Ukrainian woodworking industry in 2017 amounted to 97 989 bill. UAH, which is 16.8% more than in the previous year and 121.2% more than in 2013. For example, in Poland, the volume of intermediate consumption of woodworking industries exceeds the value of the same indicator in Ukraine 5 times, and in Germany – almost 20 in times. This comparison is a confirmation of insufficient use of resource opportunities of the domestic woodworking industry.

Chart 3. The share of costs (intermediate consumption) in the production of wood products



Source: calculated according to SSSU 2017, National accounts aggregates by industry 2017.

The production activities of the woodworking industry in Ukraine use the products of all foreign trade. In 2017, four of them ("production of wood, paper; printing and replication"; "production of chemicals and chemical products", "agriculture, forestry and fisheries", "wholesale and retail trade; repair of motor vehicles and motorcycles") accounted for 67.17% of products and services used by woodworking industries in their operating activities [SSSU 2017].

During 2014-2017, the woodworking industry of Ukraine reduced the share of its own products in the cost structure (intermediate consumption) by 5.74 pp. (Table 2). This trend is a sign of declining levels of manufacturability of domestic woodworking industries. This is explained as follows: the higher the share of woodworking products in the costs of the woodworking industry, the longer the chains of airborne forces and the fuller the operating cycle of this industrial production. Therefore, the indicator of the share of own products in intermediate consumption can also be considered a general indicator of the level of manufacturability and efficiency of any processing production.

For example, in Poland the share of wood products in the costs of the wood industry is over 36% at a level of consumption < 70%, and in Lithuania (a country with one of the highest levels of forest cover in Europe) the ratio between these indicators is even better < 15 pp.) – 43.44% compared to 58.30%, respectively. In contrast, in Ukraine the difference between the share of own products in intermediate consumption of woodworking industries and the level of consumption of the latter in 2017 amounted to 48.44 pp. (vs. 43.96 pp. in 2013).

Deepening the processing of raw materials in woodworking industries ensures the use of chemical products, whose share in the cost structure of the domestic

Table 2. Types of economic activity, the products of which occupy the largest share in the cost structure of the woodworking industry of Ukraine, in [%]

NACE activities	2013	2014	2015	2016	2017	Deviation (+/-)				
						2014-2013	2015-2014	2016-2015	2017-2016	2017-2013
Manufacture of wood, paper, printing and reproduction	34.65	33.69	33.33	35.06	28.91	–0.96	–0.36	1.72	–6.14	–5.74
Manufacture of chemicals and chemical products	16.65	16.65	17.25	15.99	16.38	0.01	0.60	–1.26	0.39	–0.27
Agriculture, forestry and fishing	6.53	6.73	8.60	8.65	10.97	0.20	1.88	0.05	2.32	4.44
Wholesale and retail trade; repair of motor vehicles and motorcycles	16.65	17.85	14.24	11.36	10.91	1.20	–3.61	–2.88	–0.45	–5.75

Source: calculated according to SSSU 2017.

woodworking industry in 2017 was 16.38% vs. 17.25% in 2015 and 16.65% in 2013. The importance of this foreign trade in the structure of intermediate consumption of the woodworking industry in Ukraine is significantly higher than, for example, in Poland (4.76%), Germany (5.65%) and Lithuania (4.37%). However, in terms of chemical consumption in woodworking, Ukraine is 1.5 in times inferior to Poland and 6.5 in times lower than Germany.

Agricultural and forestry products in the cost structure of the Ukrainian woodworking industry occupy the third position with a share of 10.97% in 2017 vs. 6.53% in 2013. During the analyzed period, the volume of consumption by woodworking industries of products of the named foreign trade, primarily wood, increased 3.7 in times. The most significant increase in the values of this indicator occurred in 2015 (by 68.39%) and in 2017 (by 48.04%). The growth of the share of agricultural and forestry products in the cost structure (intermediate consumption) of the domestic woodworking industry can be considered a sign of a decrease in the level of processing of raw materials, and hence the level of manufacturability of woodworking and resource efficiency. For comparison, in Poland this foreign trade accounts for »8%, and in Germany – about 5% of the costs of the woodworking industry.

Wholesale and retail trade; repair of motor vehicles and motorcycles is the fourth most important foreign trade in the structure of costs of the woodworking industry of Ukraine with a share of 10.91% in 2017 (vs. 16.65% in 2013). During the analyzed period, the volume of consumption of products and services of this foreign trade by woodworking industries decreased from 24.4% in 2014 to –1.0% in 2016, but in 2017 increased by 12.1%. The decrease in the share of the trade sector of the economy in the costs of the domestic woodworking industry may be a consequence of shortening operating cycles, as well as reducing the level of processing of wood raw materials that require a number of components and parts sold through the trade network. For example, in Poland, Germany and Lithuania, products and services of the trade network in the cost structure of the woodworking industry occupy the second position with shares, respectively, 13.22%, 11.30% and 13.93%.

4. Conclusion

Summarizing the results of the analysis of intersectoral relations of the woodworking industry, it can be stated that the structure of consumption of woodworking products for industrial purposes in Ukraine differs significantly from the similar structure of Poland and Germany – it has a relatively small share of construction and furniture industry. The revealed structural differences

in the intersectoral relations of the woodworking industry are one of the key reasons why the economy of Ukraine consumes woodworking products almost six times less than the economy of Poland and more than twenty times less than the economy of Germany. Thus, the provision of production resources for furniture production and the construction sector of the national economy is still an unrealized but promising niche for the domestic woodworking industry.

According to the results of the analysis of the structure and dynamics of consumption of the woodworking industry of Ukraine, it can be argued that the level of consumption of domestic woodworking industries is the highest among the EU countries. This is largely due to the presence of significant differences in the cost structures (intermediate consumption) of the woodworking industry of Ukraine and the EU. The latter is dominated by the share of woodworking products, while in Ukraine it tends to decrease. Also during 2014-2017, the share of agricultural and forestry products in the cost structure of the domestic woodworking industry increased, and, instead, the share of products and services of retail chains decreased. As a result, the degree of processing of wood raw materials decreased and the manufacturability of production deteriorated.

Hence the need to improve the structure of production of the woodworking industry in the direction of increasing production for the construction and furniture industries. It is also important to create in Ukraine such organizational, economic and institutional and legal conditions that would contribute to the growth of demand for wood products in domestic and foreign markets. Thus, promising research in this direction will relate to the construction of appropriate optimization models (conceptual and economic-mathematical) of the structural transformation of Ukrainian industry.

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Ocena porównawcza relacji międzysektorowych w przemyśle drzewnym: Ukraina, Polska, Niemcy

Streszczenie. *Autorzy przedstawiają kluczowe problemy i specyfikę rozwoju przemysłu drzewnego, porównując bliskość powiązań międzysektorowych oraz koszty produkcji drewna na Ukrainie i w krajach UE, w tym w Polsce i Niemczech. Wyniki analizy wskazują, że zużycie produktów drzewnych w gospodarce ukraińskiej jest sześciokrotnie mniejsze w porównaniu z gospodarką polską i dwudziestokrotnie mniejsze w porównaniu z gospodarką niemiecką. Okazuje się również, że koszt produkcji drewna na Ukrainie jest najwyższy ze wszystkich krajów UE. Autorzy wskazują na potrzebę strukturalnej transformacji ukraińskiego przemysłu drzewnego ze względu na malejący poziom przerobu surowca i pogarszająca się mocy produkcyjnych.*

Słowa kluczowe*: przemysł drzewny, relacje międzysektorowe, zużycie pośrednie, produkcja, konsumpcja*

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Export of flour and flour-based products in Ukraine: trends and problems

Abstract. *Today, flour products are one of the most socially important products in many countries around the world. Ukraine has a well-developed raw material potential to increase its exports of food products made with wheat flour. The article identifies the main problems affecting the development of the flour industry in Ukraine. The author analyses the dynamics of exports of flour and flour-based products and the geographical distribution of exports of finished flour products. She also proposes ways of increasing the volume of grain processing and ensuring a competitive position of Ukrainian flour products in the world market.*

Keywords: *grain processing, flour production, flour export, export of finished flour products, export orientation*

1. Formulation of the problem

Ukraine is one of the countries in the world with high potential for the development of the agro-industrial complex. In particular, the country is one of the leaders in the production and export of basic cereals – wheat (according to the International Trade Center (ITS), in the ranking of TOP-10 world exporters of wheat in 2018 Ukraine ranked 6th after the Russian Federation, Canada, USA, France and Australia). Wheat exports occupy an important place in the results of Ukraine's foreign trade (according to the State Fiscal Service of Ukraine, in 2018 the share of wheat in total exports was 6.35%). In contrast, less active industrial

production and export of finished grain products, in particular, wheat flour (and wheat-rye) and products from it. In view of this, Ukraine has become a supplier of raw materials for the production of flour products for other countries, while losing the opportunity to increase the added value of sold grain (wheat and rye).

Hence, the aim of the article is to study the export of flour (wheat and wheat-rye) and its products from Ukraine, to identify problems and trends in the export potential of this sector of the processing industry of Ukraine.

2. Literature review

Wheat flour and food products from it are socially important products and the basis of nutrition in most countries of the world. Providing the country with grain products is the basis of economic security and a normal standard of living. In view of this, the issues of production, export of wheat flour and bread products, as well as raw materials (grain production) are widely studied in Ukrainian and world science. We can note some works that highlight the place of Ukraine in the world grain market [Vasylieva 2020; Seheda 2020], the relevance of increasing the processing of wheat and rye in Ukraine [Luchechko 2020], global trends in the production and trade of wheat and rye [Enghiad et al. 2017].

At the same time, the issues of a comprehensive study of the problems of forming the export potential of flour and products of its processing (bread and bakery, confectionery and pasta) in Ukraine remain unresolved.

3. Main results of the study

In recent years in Ukraine there have been tendencies to increase the harvest of wheat and rye, in particular, in 2013-2019, the harvest of this type of grain increased by 25.07%. At the same time, the production of wheat and wheat-rye flour decreased by 33.31%, and flour products – decreased by 38.20% (Table 1).

Such trends indicate an imbalance in the production and processing of wheat and rye. We can identify the main factors that influenced the dynamics of wheat and rye processing in Ukraine, in particular the following.

Due to declining demand for grain products within the country (population decline, changing gastronomic tastes) and problems with the sale of food abroad (non-compliance of quality certificates and production technology with international standards, difficulties in establishing a market abroad and other) it is easier for producers to sell raw materials (grain) than to expand production with in-depth processing.

Table 1. Growth rate of wheat and rye production and products of their processing in Ukraine

Product	2014 / 2013	2015 / 2014	2016 / 22015	2017 / 2016	2018 / 2017	2019 / 2018	2019 / 2013
Wheat and rye (together)	7.31	7.91	–0.38	0.87	–6.25	14.65	25.07
Wheat flour and wheat-rye flour	–7.52	–6.48	–4.01	0.02	–17.20	–3.01	–33.31
Flour products, including:	–14.02	–9.59	–4.26	–5.42	–9.94	–2.51	–38.20
• bread and bakery products, short-term storage	–13.09	–9.22	–5.84	–7.53	–11.50	–10.03	–45.31
• confectionery	–23.52	–9.82	–1.12	7.29	–2.54	32.27	–5.68
• uncooked pasta	1.00	–14.06	10.48	–8.03	–10.09	–10.03	–28.65

Source: based on data from SSSU 2019a, 2019b.

Existing plants for the production of flour and flour products need to be re-equipped and improved production technologies (in accordance with market requirements), and the creation of new production is even more expensive. Therefore, there is a problem in investment resources to create a competitive business.

The level of profitability of operating activities for the production of flour and flour products is several times lower than the level of profitability of grain production. For example, in 2018, the operating profitability of growing cereals in Ukraine was 20.8%, and the production of flour and bakery and flour products – 3.2%.

Against the background of these trends in production, we can observe a steady increase in exports of wheat and rye from Ukraine (Table 2). At the same time, exports of flour and cereals had unstable trends. Thus, in 2013-2019, the growth rate of exports of flour and cereals industry increased to 47.55%, but the values fluctuated: in 2016, 2017, 2019 – there was an increase in the indicator; in 2014, 2015, 2018 – reduction.

Also, the decline in the production of finished grain products had a negative impact on exports of these products: in recent years, the growth rate of exports of finished grain products decreased by 34.67%.

The largest importers of bakery and flour products from Ukraine in 2019 were Belarus, Romania, the Republic of Moldova, Kazakhstan, Azerbaijan (Table 3). The main buyer of flour in 2019 was North Korea. In recent years, the demand for Ukrainian flour is growing in the Middle East and Africa. Confectionery was mostly exported to Belarus, Kazakhstan, Yemen, and Poland. Pasta – the Republic of Moldova, Great Britain, Germany.

Ukraine is characterized by a steady increase in the level of export-oriented production of grain, flour and flour products. However, in the ratio between the volume of production and exports of these products there is a significant imbal-

Table 2. Growth rate of exports of wheat and rye, flour products and finished grain products

Classification code	Product	2014 / 2013	2015 / 2014	2016 / 2015	2017 / 2016	2018 / 2017	2019 / 2018	2019 / 2013
II (10).	Cereals,	3.03	–7.44	0.27	7.03	11.37	33.05	51.67
	including:							
	1001. Wheat	21.21	–2.36	21.39	1.53	8.89	–	–
	1002. Rye	176.41	–67.67	–68.53	311.65	298.97	–	–
II (11).	Products of the flour and cereal industry,	–9.19	–5.24	17.63	31.17	–3.34	14.97	47.55
	including:							
	1101. Wheat flour	1.66	–4.63	7.76	29.89	–26.24	–	–
IV (19).	Finished grain products	–5.38	–31.33	–20.70	39.52	–9.48	0.40	–34.67
	including:							
	1902. Yeast-free dough products	–7.56	–17.37	–13.55	23.21	10.16	–	–
	1905. Baked goods	–30.57	–49.55	24.93	9.89	–8.77	–	–

Source: based on data from SFSU 2019.

Table 3. Rating of countries-importers of bakery and flour products from Ukraine

Place in the ranking	Country	Export amount [thousands of US dollars]	Share of export amount [%]
1	Belarus	22623.13	13.04
2	Romania	18102.50	10.44
3	Republic of Moldova	17236.39	9.94
4	Kazakhstan	12037.70	6.94
5	Azerbaijan	10294.10	5.93
6	Poland	7947.25	4.58
7	Georgia	7432.74	4.28
8	Germany	7193.70	4.15
9	Libya	6599.17	3.80
10	Turkey	6196.92	3.57
Sum		115663.60	66.67
Total exports		173477.50	100.00

* Source: based on data from SFSU 2019.

ance: the export-oriented production of cereals is significantly higher than in the food industry. Thus, in particular, the share of exports in wheat production in 2018 exceeded the similar indicator of flour milling products by 3.54 times, and finished grain products – by 4.87 times (Table 4).

Table 4. Share of exports in the issue

Classification code	Product	2013	2014	2015	2016	2017	2018
II (10).	Cereals, including:	16.45	23.55	30.57	34.74	36.23	28.89
	1001. Wheat	34.84	43.73	50.70	68.81	66.19	66.54
	1002. Rye	2.48	12.32	5.81	1.57	4.93	26.39
II (11).	Products of the flour and cereal industry,	9.31	11.52	14.92	18.81	22.49	18.78
V (19).	Finished grain products	10.89	11.88	12.02	10.17	13.68	13.67

Source: based on data from SFSU 2019.

At the same time, the import dependence of the domestic consumer market of food products (in the segment of flour products) in Ukraine is low. Thus, the share of imports in the retail turnover of bakery products is 2.6%, confectionery – 6.9%, flour – 5.1%, while pasta – 25.1%.

The identified trends in the dynamics of imports of flour and flour products are mainly due to changes in food culture, which require expanding the range of products in accordance with the requirements of modern demand. Ukrainian producers of ready-to-eat grain products are mostly reluctant to invest in modernization and expansion of production (purchase of new technological lines to expand the range of products), inclining to export raw materials. Accordingly, imports are growing, in particular, organic, gluten-free and other products.

Grain processing is one of the most promising areas for the development of agro-industrial production, given the growing demand for these crops and products of their processing on the world market.

Ukraine has a strong raw material potential for the development of food industry, in particular, in the segment of flour products. However, in Ukraine a meager share (6.54% in 2018) of grain (wheat and rye) is processed, while the main part is exported.

Capacities of Ukrainian flour mills are loaded only by 30-50%. At the same time, due to the low profitability of this production, companies can not independently provide equipment upgrades and technology upgrades.

One of the key factors in the development of flour and flour products export is the change in the ratio between the production of raw materials, products of primary processing (flour) and finished products.

Global trends indicate an increase in demand for food (primarily due to the growing population of the planet), which in the long run may allow Ukrainian producers to strengthen their competitive position in the international food market.

The most promising free niches in this segment are organic and gluten-free grain products, as well as cheaper (traditional nomenclature) products that are in demand in countries with high population growth rates (Africa and Asia).

Some grain products made in Ukraine (wheat flour, pasta, gingerbread, etc.) have already taken their niche in the foreign market. However, to further strengthen the competitive position it is necessary to continuously improve the quality and expand the range of products and improve the technology of its production, in accordance with the requirements of modern international standards and regulations.

4. Conclusion

The main tasks aimed at achieving Ukraine's status as a leading exporter of flour and flour products on the world market, include:

– introduction of innovative technologies for growing grain crops and, at the same time, increasing the level of technical equipment of flour mills to improve the quality of finished products while meeting the requirements of world standards;

– stimulating cooperation and integration (horizontal-vertical) of agricultural and industrial producers in the processes of primary processing, procurement and sale of manufactured products;

– improvement of promotion and logistics of promotion of goods of the domestic food industry on the world market in order to avoid potential losses in price and quality;

– intensification of activities in the direction of creating favorable institutional conditions for further development of powerful export-oriented industries and, at the same time, development of small and medium enterprises that produce goods with high added value, in particular, on the basis of organic products of plant origin;

– stimulating the export activity of agro-industrial entities by providing them with organizational, technical and informational support in the direction of improving the product quality management system and ensuring international certification of production.

Implementation of the outlined tasks will allow Ukrainian producers not only to consolidate their positions in the world market, but also to expand both the geographical structure of exports (markets by countries and regions) and the product range of exported agricultural products, in particular, in premium segments.

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Eksport mąki i przetworów mącznych na Ukrainę: trendy i problemy

Streszczenie. *Obecnie produkty mączne są jednymi z najważniejszych społecznie produktów w wielu krajach na całym świecie. Ukraina posiada dobrze rozwinięty potencjał surowcowy do rozwoju eksportu produktów spożywczych z mąki pszennej. W artykule zidentyfikowano główne problemy wpływające na rozwój przemysłu mącznego na Ukrainie. Analizowana jest dynamika eksportu mąki i produktów z niej pochodzących. Zbadano strukturę geograficzną eksportu gotowych produktów mącznych. Proponuje się sposoby zwiększenia przerobu zbóż i zapewnienia konkurencyjnej pozycji ukraińskich produktów mącznych na rynku światowym.*

Słowa kluczowe: *przetwórstwo zbóż, produkcja mąki, eksport mąki, eksport gotowych wyrobów mącznych, orientacja eksportowa*

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Implementation of the UE regional policy in the conditions of an exclusively regulated economy

Abstract. *The authors analyse the concepts of divergence and convergence in relation to the process of Ukraine's integration with the EU. A number of factors inhibiting the convergence process are identified. A comparative analysis with Ukraine's trading partners is also conducted in order to reveal the essential characteristics of the exclusive regulatory system governing the Ukrainian economy.*

Keywords: *implementation, international trade, structural divergence, exclusive factors, convergence, complementarity, integration*

1. Introduction

During the twenty-year period of 1998-2017, there were no significant changes in the pace of "catching up" development of the newly independent countries (NNCs) to the world average (in terms of GDP per capita). Moreover, there was a deterioration in the competitive position of NSCs, including Ukraine [Krysovatyy et al. 2018]. The search for a macromodel of development on the basis of alterglobalism becomes imperative for our country.

Considering the alterglobal vector of development of the network society in the monograph [Mokiy, Zvarych, Naumenko 2019], published in 2019, we emphasized the uncertainty of global challenges of negative technological, environmental events and noted that "such events include pandemics, climate change, economic crises, wars, large-scale man-made disasters and geopolitical changes. It is difficult to predict the location and type of pathogen that may spread. A new respiratory pathogen that spreads easily, kills or incapacitates more than one percent of patients is one of the most likely devastating events. Such an outbreak of a pandemic could lead to the suffering and death of millions of people in the world within six months" [Mokiy, Zvarych, Naumenko 2019]. As we can see, large-scale demographic and environmental changes are happening much faster than expected, and their consequences can be predicted only after they occur.

Recognition of the objective regularity of economic globalization does not deny the expediency of shifting the vector of national development to the paradigm of alterglobalization, as complementary and one that takes into account the interests of the participating countries. At the same time, alterglobalization should be carried out not chaotically, but under the influence and control of the national government, as well as interested international organizations and civil society institutions. The determinants of development, due to the activities of the subjects of the global metasystem, the forms and methods of management used by them, tools and means of their implementation, which become imperative but are used within the institutional basis of national security, are important.

Economic growth needs new impulses acceptable to participating countries in the context of global, including megaregional competition. Taking into account the systemic shortcomings of the neoliberal model, the national development strategy on an alter-global basis should take into account: synchronization of economic cycles and uncertainty of the time of onset and scale of crisis phenomena; gradual approval of post-industrial production; clear demarcation of market and non-market sectors of the economy; changing the ratio of real and "virtual" economies; the level of cultural integration and socio-global polarization [Mokiy, Zvarych, Naumenko 2019], as well as integration into megaregional economic entities as again complementary to the processes of global economic integration. The goal of megaregional integration is undoubtedly the convergence of the macroeconomic systems of the participating countries. However, in the functioning of interregional economic entities, along with convergence, there are processes of divergence of economies, which is especially important for our country.

Semantic analysis can be attributed to essential characteristics of the concept of "divergence" such as: isolation; movement in different directions; to disperse; to diverge; **the divergence of characteristics and properties; adaptation to different conditions of existence** (underlining ours). In contrast, the term "convergence" means the convergence, the convergence due to the immediate

interaction, prolonged and close contact, the historical development regardless of common descent. That is, in the semantic dimension, first of all, we are talking about the process **of adaptation to the environmental conditions of the operation, the result of close cooperation, or lack thereof** (underlining ours). It is movement, development, adaptation to the environment; the separation (divergence); convergence is the key to the semantic interpretation of terms. Of course, this is not determined by purpose, time period and factors (external or internal) convergence (divergence) that need to be considered when undertaking institutional analysis. We emphasize, remains the dominant feature is the movement, in A. Lange: "amateur dialectical process in which contradictions in the system cause its constant movement and development" [Lange 1969].

At this stage of development of the global economy it is necessary to recognize the truth of A. Hal'chyns'kyy statement in 2002 at the beginning of the European integration process that globalization failed to "ensure the convergence of states in living standards and reduce the depth of interstate stratification" [Hal'chyns'kyy 2002], extending this statement to the megaregional integration, including the European integration of Ukraine. Assessing the state and prospects of convergence of the socio-economic macrosystem of Ukraine and the megasystem of the European Union and the threat of their further divergence, we pay attention to the influence of the dysfunction of the institution (system), which O. Sukharev understands as a reduction of qualitative characteristics, as well as the economy in general, or management, a sign of which is the loss of the institution of this goal, the erosion of the scope of efforts, functions, due to this increase in transaction costs and reduced resistance to random modifications" [Sukharev 2016]. In fact, management dysfunction in the process of integration of these non-complementary (if not antagonistic) large systems, which turns into "forced" implementation of perfect (relatively) institutions of the EU megasystem into an exclusive management system of socio-economic development of Ukraine, is the main cause of divergent trends. Agreeing with D. Rusak on the role of US TNCs in shaping the industrial sector [Rusak 2018], we draw attention to the similar role of TNC networks of EU member states in "permeating" and strengthening the resilience of this megaregional integration entity to global challenges. That is, the dysfunction of the integrated megasystem is mitigated by the compensatory mechanisms of transnational networks. In the domestic macrosystem, such networks of TNCs of national origin do not exist, and, if they do exist, they are aimed not at achieving the strategic goals of national security of development, but at ensuring in explicit or implicit form only the economic interests of extreme beneficiaries.

If the convergence (divergence) implies convergence (divergence) macrosystemic indicators of development, structural change of the divergence of sFubjective-objective characteristics of the process: the divergence is not only

spatial units (regions, cities, rural settlements), territorial communities, but also the industry sector, the economy and society (scientific and technological, educational and health and the environment). The divergence covers the development of the primary element of the macrosystem of a person, family, household, human capital through the vectors of their motion, stratification of the population by income, sources of origin, degree of legitimacy of ownership, quality of life and safety. Moreover, divergent trends are observed in the structure of the macro – relations between its elements.

Structural divergence is a prerequisite for the destruction of the integrity of the state's macrosystem in the face of the negative impact of geopolitical challenges. It is structural divergence – "disagreement", the destruction of existing relatively inclusive relationships, which are transformed into exclusive extractive institutions-regulators of socio-economic development of the national macrosystem, aimed at maximum "extraction" of income from the exploitation of one part of society and focus on its interests parts, according to D. Ajemoglu, J.A. Robinson [2012]. Tracing the relationship and synergy between political and economic institutions, they emphasize that a synergistic effect can be obtained for inclusive institutions, as opposed to extractive ones.

That is why, assuming the identity or similarity of extractive with/and official institutions, transformed (modified) under the influence of exclusive regulatory actions (in a broader sense – management) socio-economic development of regions, we will focus on the ranking of terms (concepts) included in the word exclusivity of regulation of social and economic development (SER) of regions (Fig. 1).

Structural divergence in Ukraine is manifested in the divergence of elements at different levels of the system hierarchy and covers the development of the primary element of the macrosystem – man, family, household, human capital due to different vector of their movement, stratification by income, sources of origin, degree of legitimacy, quality level life and safety of life, as well as the structure of the macrosystem in the relationship between its elements. The objects of divergence are spatial units (regions, cities, rural settlements, territorial communities; industries, sectors, spheres of economy and society (scientific and technological, educational and health and environmental protection).

Structural divergence of the economy of Ukraine due to systemic problems, including exclusivity regulation of economy with the characteristics: the process is exceptional (selective) exposure of regulatory (administrative) actions of individual actors or groups of economic actors, the political activities of institutions and management functions, resulting in dysfunction control macrosystem; the set of subjects exclusive of the regulation includes domestic subjects (groups of subjects) economic, political activities, and subjects (groups of subjects) of other countries for urgent satisfaction of their own economic interests in direct

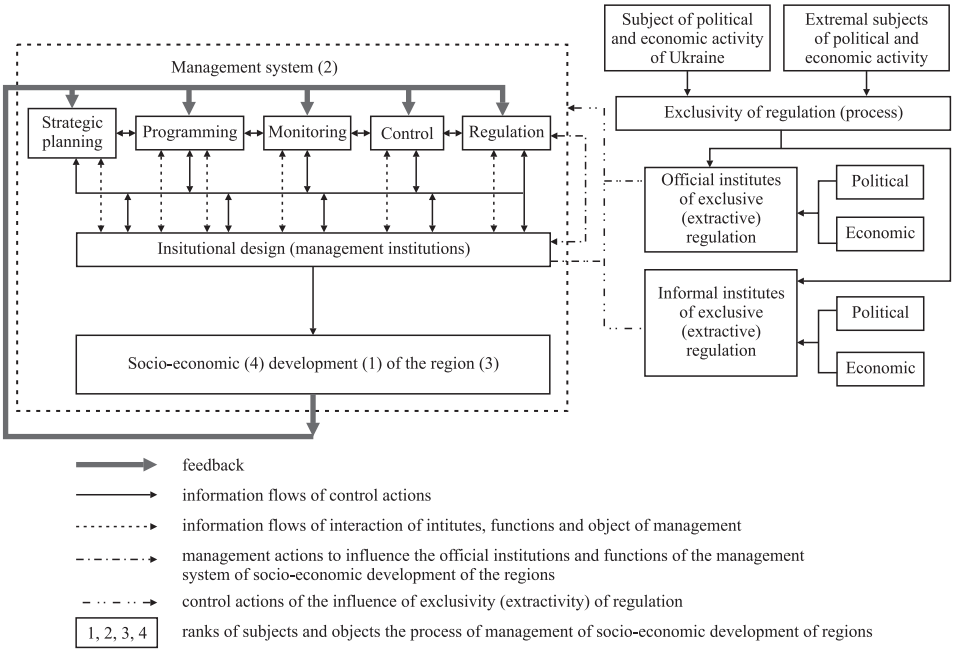


Fig. 1. Conceptual structural and functional scheme of the process of exclusive regulation of socio-economic development of regions

Source: author's development.

or hidden (for the subjects of political activity) forms; to the subjects of political activity are representatives of state administration bodies of various levels in the hierarchy with the dominance of private economic interests and the interests of the beneficiaries they represent in government, political parties, organizations, associations, etc.; substantial subject-object and functional uncertainty and non-transparency in exclusive control; disharmonise the goals and objectives of the subjects of exclusive regulation and the objectives of the national socio-economic macrosystem.

Let us make an assumption, which still requires thorough research, that the period with intrasystemic and external (aggression of the Russian Federation) factors of structural divergence, these include European integration in the implemented model of asymmetric trade, migration, labor, capital movement, labor transfer. To confirm this assumption, we present the results of the analysis of the dynamics of complementarity index and geographical structure of bilateral trade with the European Union and the Republic of Turkey and China during the Association Agreement between Ukraine and the EU (2014-2019).

2. Theoretical framework

To predict the effectiveness and prospects of foreign economic activity, tools of economic and mathematical modeling are used. Most macroeconomic models of international economic relations are divided into two subtypes: 1) ex-ante models – preliminary analysis of indicators to model future scenarios of economic development in the process of changing trade conditions (in connection with WTO accession, free trade zone, customs union, others economic groups); 2) ex-post models – post-factual analysis to assess the effectiveness of trade and economic policy, built on the basis of statistical indicators of previous periods (assessment of the effectiveness of bilateral trade and economic policy).

Ex-ante analysis methods include partial equilibrium (analysis of trade policy implementation and import restrictions in a particular sector) and general (determining profits or losses, limiting resources between several markets) equilibrium, static and dynamic equilibrium models; The main tools of ex-post analysis are the following models: multidimensional statistical analyzes (BSA), regression equations, one- and multifactor regressions, autoregressions (including ARIMA), vector autoregressions, etc. The logic of such approaches is related to the nature of relationships between variable parameters, due to the macroeconomic situation and the political situation in the country and allow to predict events in the near future.

An additional tool for determining the effectiveness of foreign economic relations, in particular in the aspect of trade – the dominant component, are indicators of international trade, which are actively used by international financial institutions, which include indices [Balassa 1965]: revealed comparative advantage (*RCA*); trade complementarity index (*TC*); foreign trade intensity index (*TI*); intra-industry trade index (*IIT*); trade specialization index (*TS*), which will determine the qualitative parameters of cooperation, threatening and destructive trends and determine the prospects for relations between partner countries, taking into account the substantive characteristics of the methods used.

Export/Import Coverage (XMC_j) is an indicator of relative coordination, which reflects the excess of exports over imports, ie the number of exported goods per unit imported. In essence, this indicator allows you to analyze the level of foreign trade self-sufficiency of the country.

The import-export coverage ratio (XMC_j) is calculated by the formula:

$$XMC_j = \frac{X_j}{M_j} \tag{1}$$

where:

j – the country whose trade is analyzed;

X_j – the volume of total world exports of goods of the j-th country;

M_j – the volume of total imports of goods of the j-th country.

The coefficient can take values from 0 (complete absence of export) to +∞ (complete absence of import). A value of $XMCj = 1$ reflects the full coverage of imports by exports (a state of perfectly balanced trade). The complementarity index of foreign trade (TCI_j) is calculated by the formula:

$$TCI_j = 100 - \sum \frac{m_{ik} - x_{ij}}{2} \tag{2}$$

where:

m_{ik} – part of good i in total imports of the country k;

x_{ij} – part of the export of the i-th goods of the country j.

The theory of international trade states that certain advantages of trade provide specialization in the sector of comparative advantage of the country. The Index of Identified Comparative Advantages (*RCA*) shows in which goods a country has comparative advantages.

$$RCA_j = \frac{X_{kj} / X_j}{M_{kw} / M_w} \tag{3}$$

where:

X_{kj} – exports from the country and goods to;

X_j – total exports from country i;

M_{kw} – world imports of goods to;

M_w – total world imports.

The *RCA* index is equal to the ratio between the share of a product in the country's total exports and the share of the same product in world trade. This index is calculated to determine whether a country has a competitive advantage over a particular product. If $RCA > 1$, it is concluded that the country is more export-oriented for this product and has a competitive advantage.

Similarly, the *RCD* index (Import Specialization Index) is equal to the ratio of the share of a particular product in the country's total imports and its corresponding share in world trade:

$$RCD = \frac{M_{kj} / M_j}{M_{kw} / M_w} \tag{4}$$

where:

M_{kj} – import of the country j goods k;

M_j – total imports from country j;

M_{kw} – world imports of goods to;

M_w – total world imports.

If the $RCD > 2$ (high import specialization); $RCD < 0.75$ (no import specialization); $0.75 < RCD$.

3. Analysis of results

The strengthening of the divergence of the economies of Ukraine and the EU in 2014-2019 is reflected in the tendency to maintain the "gap" between Ukraine, the EU, the countries of the "second wave" of European integration (Fig. 2).

It should be noted that there is a divergence not only of the economies of Ukraine and the EU, thoroughly covered by T. Burlay (Burlay, 2019), but also the divergence of the socio-economic macrosystem of Ukraine, which manifests itself in differences in elements at different levels of the system hierarchy.

Analysis of the dynamics of the main indicators of bilateral trade between Ukraine and China (Table 1), in particular: the volume of exports and imports of goods and trade balance; coverage of imports by exports (Table 2) allows to state the instability of trade conditions, the predominance of imports over exports.

Exports of goods from Ukraine to China in 2018 amounted to $2.2 billion. USA (4.7% of total exports) and imports – $7.6 million. USA (13.3% of total imports). As of 2013, the coverage ratio of imports to exports China is below one (in 2018 is 0.3), and the balance of foreign trade turnover is negative (in 2018 5,4 billion. USA), that is, since 2013, has a strong negative character. A negative trade balance of Ukraine with China is aggravating the difficult situation in foreign trade. The balance of Ukraine's foreign trade with Turkey in 2013 for 2018 has a positive value, the coverage ratio of imports by exports is greater than 1, that is, in the foreign trade relations is dominated by exports. Critical high value, the coverage ratio of imports by exports observed in 2001 and 2018 10 and 14, respectively.

In the geographical structure of Ukrainian exports and imports (Fig. 3a, b), the EU occupies a leading position. Namely, the share in total exports in 2018

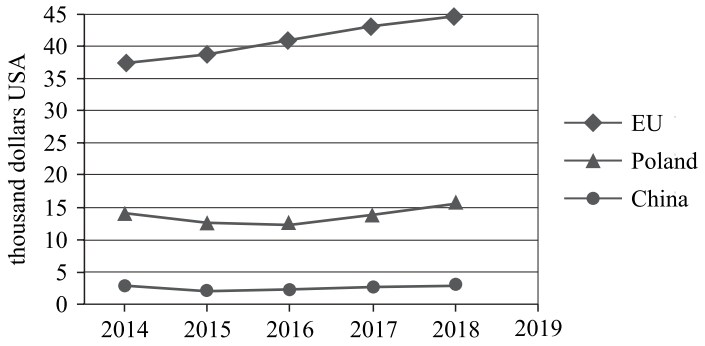


Fig. 2. Dynamics of GDP of the EU, Poland and Ukraine, thousand dollars USA, per person, 2014-2019

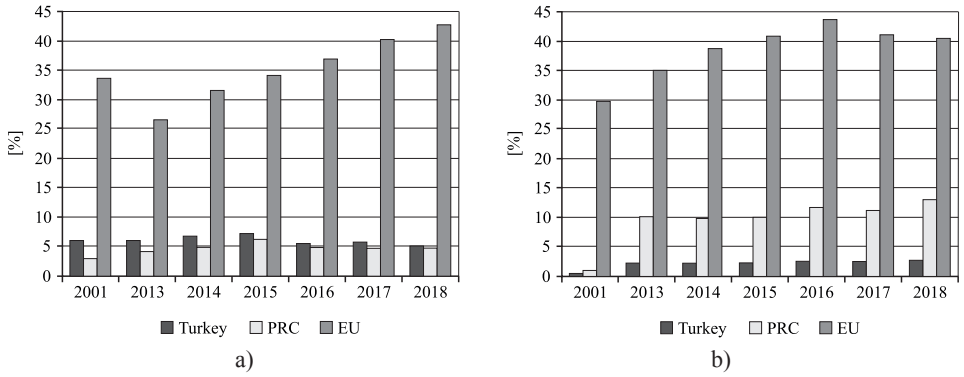
Source: World Economic Outlook Database, 2019; author's calculations.

Table 1. Dynamics of the main characteristics of bilateral trade in goods between Ukraine, the EU, Turkey and China, 2001, 2013-2018

Years	EU					Turkey					PRC					Export total [billion dollars USA]	Import total [billion dollars USA]
	Exports [billion dollars USA]	Share in total exports [%]	Imports, [billion dollars USA]	Share in total imports,%	Balance, [billion dollars USA]	Exports [billion dollars USA]	Share in total exports [%]	Imports [billion dollars USA]	Share in total imports [%]	Balance, billion dollars USA	Exports [billion dollars USA]	Share in total exports [%]	Imports, [billion dollars USA]	Share in total imports [%]	Balance [billion dollars USA]		
2001	**5.5**	**33.74**	**4.7**	**29.75**	**0.8**	**1.0**	**6.13**	**0.1**	**0.63**	**0.9**	**0.5**	**3.07**	**0.2**	**1.27**	**0.3**	**16.3**	**15.8**
2013	16.8	26.54	27.0	35.06	–10.2	3.8	6.00	1.9	2.47	1.9	2.7	4.27	7.9	10.26	–5.2	63.3	77.0
2014	17.0	31.54	21.1	38.86	–4.1	3.6	6.68	1.3	2.39	2.3	2.7	5.01	5.4	9.94	–2.7	53.9	54.3
2015	13.0	34.12	15.3	40.80	–2.3	2.8	7.35	0.9	2.40	1.9	2.4	6.30	3.8	10.13	–1.4	38.1	37.5
2016	13.5	37.09	17.1	43.62	–3.6	2.0	5.49	1.1	2.81	0.9	1.8	4.95	4.7	11.99	–2.9	36.4	39.2
2017	17.5	40.32	20.3	41.09	–2.8	2.5	5.76	1.3	2.63	1.2	2.1	4.84	5.6	11.34	–3.5	43.4	49.4
2018	**20.2**	**42.71**	**23.2**	**40.56**	**–3.0**	**2.4**	**5.07**	**1.7**	**2.97**	**0.7**	**2.2**	**4.65**	**7.6**	**13.29**	**–5.4**	**47.3**	**57.2**

Source: International Trade Center 2020; author's calculations.

Fig. 3. The share of countries in total exports (a), imports (b) of Ukraine in 2001, 2013-2018



Source: International Trade Center 2020; author's calculations.

is 42.7%, and the share of imports – 40.56%. Also significant countries in the structure of exports and imports of Ukraine are occupied by such countries as Turkey and China.

The ratio of import coverage to exports (Table 2) in 2018 is approaching 1, which reflects the state of perfectly balanced trade.

A comparative analysis of the complementarity index (Table 3) shows that in 2019 Ukraine's exports met the needs of the EU, Turkey and China by only 34.7%, 37.52% and 34.96%, respectively, and since 2014 there has been a trend

Table 2. Coverage ratio of imports by exports (XMC_j)

Countries	2001	2013	2014	2015	2016	2017	2018
EU	1.2	0.6	0.8	0.9	0.79	0.9	0.9
Turkey	10.0	2.0	2.8	3.1	1.8	1.9	1.4
PRC	2.5	0.3	0.5	0.6	0.4	0.4	0.3
Total coverage ratio	1.03	0.8	1.0	1.0	1.0	0.9	0.8

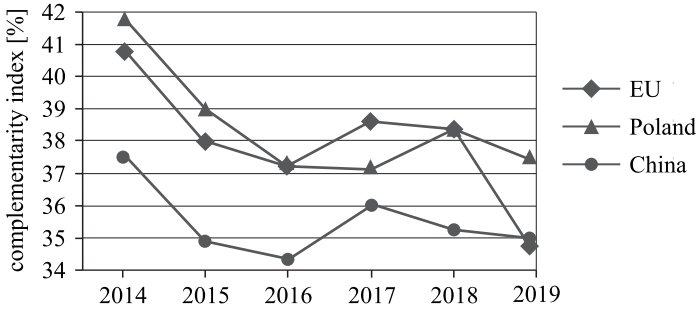
Source: International Trade Center 2020; author's calculations.

Table 3. Complementarity index of bilateral trade of Ukraine with the EU, Turkey and China, 2014-2019 [%]

Countries	2014	2015	2016	2017	2018	2019
EU	40.78	37.96	37.22	38.63	38.40	34.70
Turkey	41.72	39.04	37.24	37.22	38.35	37.52
PRC	37.52	34.94	34.34	36.07	35.28	34.96

Source: International Trade Center 2020; author's calculations.

Fig. 4. Dynamics of change in the complementarity index of foreign trade of Ukraine with the EU, Turkey and China, 2014-2019



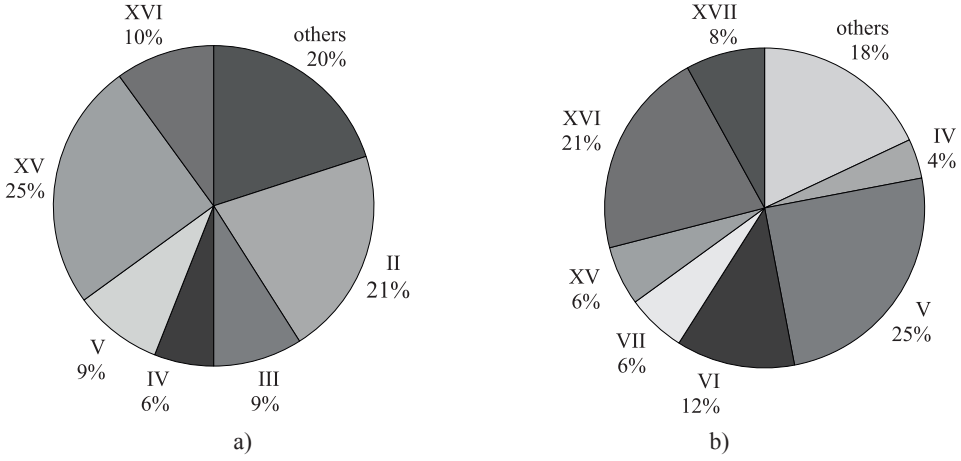
Source: International Trade Center 2020; author's calculations.

towards decrease in the complementarity index of trade with the EU by 6.08 percentage points, with Turkey – by 4.2 percentage points, with China – by 2.56 percentage points.

At the same time, throughout the period under study, there was a declining and uneven abrupt dynamics of index change (Fig. 4), which significantly complicates, among other factors, the possibility of strategic and even medium-term programming of foreign trade relations.

Based on the calculation of export specialization indices (RCA) and imports (RCD), the main groups of Ukrainian exports in 2018 (Fig. 5a) were base metals

Fig. 5. Commodity structure of exports (a), imports (b) of Ukraine in 2018



Source: State Statistics Service of Ukraine, 2020.

(25% of total exports), plant products (21%), mechanical equipment; machines and mechanisms (10%), mineral products (9%), fats and oils of animal or vegetable origin (9%), ready-made food products (6%).

The main groups of imports in 2018 (Fig. 5b) include mineral products (25% of total imports), mechanical equipment; machinery and equipment (21%), products of chemical and allied industries (12%), vehicles, equipment and devices (8%), polymeric materials, plastics and articles thereof (6%), base metals %) and finished food products (4%).

4. Discussion & recommendations

At present, there is a need for an in-depth analysis of the results of the implementation of the Association Agreement between Ukraine and the EU, other intergovernmental agreements on trade partnership, which, accordingly, requires the development of a methodology for such analysis. Based on the provisions of E. Reinert's Other Canon [Reinert 2010], strategic forecast estimates of increasing returns, declining or rising expenditures, synergies from the emulation and assimilation of successful trade policies of partner countries, including the European Union, seem appropriate.

In the theoretical basis of the methodology of substantiation of trade partnership, including the deepening of the European integration process in the direction of gaining the status of an EU member state, unfortunately absent in the development strategy of Ukraine in recent years, seem rational statements outlined in [Reinert 2007, 2010], supplemented by an institutional analysis of the similarity of socio-economic macrosystems of partner countries, their complementarity or antagonism, cultural, linguistic and civilizational distance, justification of the use of protectionism, as well as – protection of foreign trade security [Vlasyuk 2018].

At this stage of the study, we suggest that the internal structural divergence of the economy, as well as the divergence of the economies of Ukraine and the EU due to systemic differences, which include, first of all, exclusivity of regulation (management) with the following essential characteristics [Mokiy 1999]:

1. Exclusivity of regulation of socio-economic development (SER) is a process of exceptional (selective) influence of regulatory (managerial) actions of individual subjects or groups of subjects of economic and political activity on institutions and management functions that cause macrosystem management dysfunction.

2. The set of subjects of exclusive regulation includes domestic subjects (groups of subjects) of economic, political activity, and also subjects (groups of subjects) of other countries for which the purpose is the primary satisfaction of own economic interests in direct or hidden (for political actors) forms.

3. To the subjects of political activity are representatives of state administration bodies of various levels in the hierarchy with the dominance of private economic interests and the interests of the beneficiaries whom they represent in government, political parties, organizations, associations and the like.

4. Developed substantial subject-object and functional uncertainty and non-transparency in exclusive regulation, that is, there can be a clear and public definition of the subjects, their interests and exclusive regulatory influences on the functions of government.

5. The dominant feature of the essential feature of exclusivity of regulation of socio-economic development is disharmonise goals and objectives are achieved and solved by the subjects of exclusive control with goals and objectives development of the national socio-economic macrosystem.

6. Significant ambivalence is inherent in taking into account the impact of economic activity in the medium and long term on the security of the state, its demographic, intellectual, scientific and technological, environmental, financial and investment and even military and economic components.

At this stage of Ukraine's development, exclusive political and economic institutions still differ from the extractive institutions of the Congo and other underdeveloped countries described in [Acemoglu, Robinson 2012], but striking examples of their use in growing, extracting and foreign trade in crop products, forest timber, amber, etc., give grounds to assume their convergence and increase the impact on economic divergence as a threat to national security. We emphasize that without overcoming the exclusivity of economic management, the systemic integration of Ukraine into the European Union in the medium term is impossible, only the model of structural European integration described by us in [Mokiy 1999] remains real.

In our opinion, the systemic problems of implementation of the institutional basis of EU regional policy in Ukraine are as follows: institutional uncertainty of regional policy actors; insufficiently exhaustive list and technical characteristics of property objects used in the implementation of regional policy; unresolved problems of resource provision of primary subjects of regional policy – territorial communities, which significantly limits the possibilities of implementation of principles, goals, objectives and organizational and institutional mechanisms of EU regional policy in Ukraine; disproportion and insufficient consideration of the interests of regional development (in the Association Agreement between Ukraine and the EU and the Action Plan for its implementation, only 4 measures out of 488 are devoted to regional policy! (Articles 446-451 of Chapter 27 "Cross-border and regional cooperation"); and the bias of effective indicators of regional development programs; inconsistency of the regional component of investment policy in Ukraine – unjustified liberalization of the internal quality control system.

5. Conclusion

We have proposed the following areas for solving system problems:

– to supplement the Action Plan of the Cabinet of Ministers of Ukraine on the implementation of the Association Agreement with measures for the implementation of the EU regional policy;

– review the legal framework of regional policy, make additions to the implementation of European practices of regional governance and adopt the State Strategy for Regional Development for 2020-2027 and provide in the Action Plan for its implementation for 2021-2023 the implementation of international projects of institutional infrastructure (technological parks, smart specialization, circular economy, etc.;

– to establish in all normative-legal acts, which regulate the issues of the state regional policy, clear priorities of the right of the territorial community to local self-government;

– to determine indicators of sustainable development, first of all, of territorial communities as the resulting indicators of efficiency of realization of the state regional policy;

– review development strategies and investment passports of territorial communities, areas;

– recognize the need to justify the feasibility of investment projects and assess the social, economic, environmental effects for local communities, taking into account the will of the communities themselves.

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Realizacja polityki regionalnej UE w warunkach gospodarki funkcjonującej na zasadach sprzyjających wykluczeniu

Streszczenie. *Autorzy analizują koncepcje dywergencji i konwergencji w odniesieniu do procesu integracji Ukrainy z UE, identyfikując szereg czynników hamujących proces konwergencji. Przeprowadzona została również analiza porównawcza z partnerami handlowymi Ukrainy, aby ujawnić podstawowe cechy gospodarki ukraińskiej opartej na zasadach sprzyjających wykluczeniu większości obywateli z korzyści płynących z działalności ekonomicznej.*

Słowa kluczowe: *wdrażanie, handel międzynarodowy, dywergencja strukturalna, czynniki wykluczające, konwergencja, komplementarność, integracja*

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Analysis of consumption and its safety in the process of sustainable development: a regional aspect

Abstract. *The authors propose a composite indicator to classify countries in terms of the level of consumption. The indicator reveals the uneven distribution of consumption in the world, which is determined by the GDP, population and quality of life in the analysed countries. The authors identify relationships between the composite indicator of the level of consumption of goods (services) by households and GDP per capita and as well as the Human Development Index. They also provide correlations of separate indicators of financial capacity and the level of well-being of the population with indicators of the level of consumption. This taxonomic analysis is used to determine the level of consumption in Ukraine.*

Keywords: *quality of life, level of consumption, GDP, human development index, consumption safety*

1. Introduction

The close relationship and interdependence of consumption safety with the quality of human life, reflected in meeting personal needs in comparison with income based on personal awareness of personal security, leads to systematization

and generalization of methodological approaches to assessing world rankings, which reflect the components of quality of life development (human development, quality of life, methodologies of the European Statistical System Committee, International Living, Organization for Economic Cooperation and Development, Good Country Index, World Happiness Report, International Quality of Life Standards Index, World Prosperity Index).

According to the ranking of countries on the index of sustainable development in 2017 (Table 1), Ukraine is in the 130 position out of 137 countries.

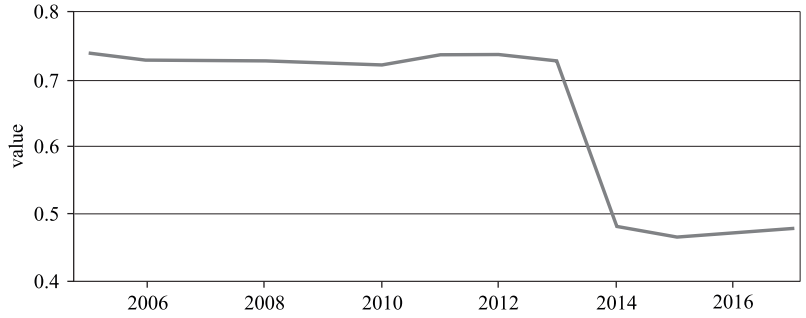
Table 1. Ranking of countries according to the Sustainable Development Index (SDI) and its components, 2017

SDI position	Country	SDI	QLC position	Quality of Life Com-po-nent (QLC)	Economic index	Environ-mental index	Social and institute-onal index	SLC position	Safety of Life Com-ponent (SLC)
1	Canada	1.109	11	1.414	0.738	0.755	0.683	1	1.720
2	Germany	1.098	7	1.419	0.760	0.745	0.681	2	1.674
3	Australia	1.095	4	1.437	0.739	0.782	0.692	5	1.636
4	Sweden	1.089	3	1.444	0.686	0.818	0.721	7	1.602
5	Finland	1.089	8	1.419	0.664	0.821	0.706	4	1.641
6	Netherlands	1.087	13	1.404	0.739	0.714	0.696	3	1.657
7	Switzerland	1.084	1	1.452	0.803	0.779	0.675	13	1.572
8	Denmark	1.083	5	1.430	0.687	0.805	0.711	6	1.604
9	Singapore	1.079	6	1.425	0.805	0.780	0.643	10	1.599
10	New Zealand	1.077	2	1.449	0.725	0.792	0.713	16	1.553
11	Norway	1.059	12	1.407	0.687	0.778	0.699	15	1.554
12	Ireland	1.053	14	1.400	0.701	0.775	0.68	18	1.545
13	United King-dom	1.052	10	1.418	0.713	0.784	0.686	21	1.513
14	Iceland	1.050	9	1.418	0.680	0.819	0.689	23	1.504
15	Austria	1.047	18	1.369	0.665	0.775	0.674	14	1.572
130	Ukraine	0.476	80	0.824	0.311	0.679	0.492	54	1.294

Source: *Sustainable Development Modeling* 2020.

The value of the Index from 2005 to 2013 fluctuated in approximately the same range (0.72-0.74), and since 2015 has dropped significantly to 0.48 and is at a very low level (Fig. 1). This is primarily due to the low position on the component «Quality of Life», namely the Index of economic dimension (0.311), which takes into account the efficiency of the labor market, macroeconomic environment, innovation and technology of the economy, the level of financial market and infrastructure, and economic freedom of the population.

Fig. 1. Dynamics Sustainable Development Index change in Ukraine, 2005-2017



Source: *Human Development Indices and Indicators* 2018.

Spatial structural construction according to the Sustainable Development Index in the regional dimension (Fig. 2) is associated with the concentration of industrial enterprises in the regions of south-eastern Ukraine and the negative impact of environmental factors on the indicator of quality of life.

Fig. 2. Structural and geographical segmentation of the regions of Ukraine according to the Sustainable Development Index

Source: *Sustainable Development Modeling* [n.d.].

A comparative analysis of methodological approaches to assessing the quality of life of the population allowed to identify areas (environment; health; education and culture; material well-being; unemployment, employment) and relevant indicators of quality of life, directly related and used for further research on consumption safety. The quality of life in Ukraine is lower than the European average, and the positions in the studied rankings are low due to the unfavorable macroeconomic environment in the country, low productivity, innovation and technological production, as well as limited economic freedoms.

The defining indicators of the Sustainable Development Index include the index of environmental dimension, indicators of health, well-being and basic needs of the index of social and institutional dimension, which are closely related to consumption safety, which we understand as the ability of state, business and society to create conditions for conscious satisfaction by the individual (person) of the needs of self-reproduction with the provision of health, environmental protection and development of society in the present and future periods. It can be argued that even the emergence of the coronary crisis is in some way due to non-compliance and failure of consumers, producers and the state to ensure the safety of consumption.

2. Results

Consumption volumes, its structure and dynamics, availability and quality of educational, medical, cultural and other social services determine the level of socio-economic development of the country and its population. Analysis of the structure of consumption makes it possible to assess material well-being, which with the improvement of working and living conditions contributes to the growth of working capacity and cultural level of people, and identify the structure and hierarchy of needs that determine consumption based on specific economic circumstances. Setting restrictions on meeting consumer needs for the choice of consumer goods significantly increases the risks of deteriorating consumption safety.

To ensure the consumption safety, it is important to take into account the level of their consumption by the population. Therefore, to differentiate countries we use a composite indicator of the level of consumption of goods and services based on the method of multidimensional average [Kyselov 2014: 34]. To calculate as stimulants selected indicators: 1) the volume of GDP (PKS) in current prices; 2) the index of the physical volume of retail trade; 3) average monthly nominal wage (in US dollars). The following were selected as disincentives: 1) the index of final consumption expenditures of households; 2) consumer price index (Table 2).

Table 2. Standardized indicators of the level of consumption of goods and services by the population of individual countries, 2017

Country	X_1	X_2	X_3	X_4	X_5	Sum	Integral indicator Y
Armenia	0.175	0.131	0.845	0.928	0.072	2.151	0.430
Azerbaijan	0.142	0.606	0.131	0.856	0.087	1.822	0.364
Australia	0.672	0.313	0.583	0.950	0.483	3.001	0.600
Austria	0.671	0.194	0.714	0.956	0.678	3.213	0.643
Belarus	0.005	0.519	0.476	0.000	0.071	1.071	0.214
Belgium	0.606	0.213	0.702	0.958	0.507	2.986	0.597
Brazil	0.174	0.194	0.667	0.839	0.251	2.125	0.425
Bulgaria	0.270	0.469	0.631	0.972	0.130	2.472	0.494
Canada	0.657	0.338	0.583	0.961	0.599	3.138	0.628
China	0.072	0.294	0.000	0.942	0.170	1.478	0.296
Czech Republic	0.407	0.306	0.583	0.964	0.232	2.492	0.499
Denmark	0.597	0.163	0.690	0.970	0.665	3.085	0.617
Finland	0.609	0.225	0.667	0.967	0.751	3.219	0.644
France	0.580	0.313	0.702	0.975	0.629	3.199	0.640
Germany	0.664	0.256	0.667	0.970	0.760	3.317	0.663
Greece	0.454	0.000	1.000	0.992	0.208	2.654	0.531
Hungary	0.312	0.325	0.655	0.953	0.174	2.419	0.484
India	0.029	0.394	0.155	0.828	0.030	1.436	0.287
Israel	0.491	0.256	0.429	0.978	0.587	2.741	0.548
Italy	0.594	0.144	0.798	0.970	0.598	3.104	0.621
Japan	0.522	0.175	0.726	0.993	0.736	3.152	0.630
Kazakhstan	0.295	0.569	0.262	0.803	0.099	2.028	0.406
Korea	0.414	0.313	0.619	0.958	0.531	2.835	0.567
Latvia	0.375	0.256	0.524	0.964	0.137	2.256	0.451
Lithuania	0.500	0.263	0.548	0.958	0.139	2.408	0.481
Mexico	0.274	0.350	0.548	0.911	0.233	2.316	0.463
Netherlands	0.571	0.181	0.738	0.964	0.739	3.193	0.639
Norway	0.660	0.238	0.583	0.953	0.980	3.414	0.683
Poland	0.391	0.325	0.583	0.967	0.184	2.450	0.490
Portugal	0.492	0.144	0.810	0.970	0.292	2.708	0.541
Spain	0.526	0.119	0.786	0.972	0.480	2.883	0.577
Switzerland	0.873	0.294	0.631	1.000	1.000	3.798	0.759
Sweden	0.539	0.313	0.607	0.975	0.866	3.300	0.660
Tajikistan	0.000	0.750	0.238	0.831	0.000	1.819	0.364
United Kingdom	0.721	0.288	0.631	0.950	0.713	3.303	0.661
Ukraine	0.134	0.281	0.774	0.620	0.015	1.824	0.365
Uzbekistan	0.037	1.000	0.560	0.828	0.033	2.458	0.492
USA	1.000	0.294	0.583	0.961	0.804	3.642	0.728

Source: calculated by the authors.

In essence, these indicators are heterogeneous and have different units of measurement. To bring them to a comparative form, we normalize them into integrated estimates based on deviations ($x_{ij} - a$), standardized by the variational scale ($x_{max} - x_{min}$) (Table 2). Thus, for stimulators $a = x_{min}$, and for destimulators $a = x_{max}$:

$$X_{ij} = \frac{x_{ij} - x_{min}}{x_{max} - x_{min}}; \quad (1) \qquad X_{ij} = \frac{x_{max} - x_{ij}}{x_{max} - x_{min}} \quad (2).$$

The composite indicator of the level of consumption of goods and services for each country is calculated as the average value of standardized indicators (Table 2):

$$Y_j = \frac{1}{m} \sum_{1}^{m} z_{ij}. \quad (3)$$

At high values of the *i*-th feature X_i approaches 1, at low values – up to 0. The integral property Y_j has the same property: the higher the level of property development, the further the value of Y_j deviates from zero [Kyselov 2014: 35].

According to the results of the calculation, we group the countries by the level of consumption of goods and services by the population in 2017 by the value of the integrated indicator:

– Group I – very low level – values < 0.3;
– Group II – low level – the value of the integrated indicator 0.3-0.4;
– Group III – average level – values in the range of 0.41-0.5;
– Group IV – high level – values in the range of 0.51-0.6;
– Group V – very high level – values above > 0.6.

Belarus, India and China belong to the group with a very low level of consumption of goods and services (Table 3), which is explained by the significant population of India and China, the relatively small GDP in Belarus, and the correspondingly low value of GDP spent by households per capita.

The countries that were part of the USSR (Azerbaijan, Ukraine, Tajikistan) are group II with a low level of consumption of goods and services. Despite the positive changes in the development of retail trade and household consumption, GDP and average monthly wages remain very low comparing to developed countries.

The group with an average level of consumption of goods includes relatively new EU members (Bulgaria, Hungary, Latvia, Lithuania, Poland, the Czech Republic), some countries that were part of the USSR (Armenia, Kazakhstan, Uzbekistan), as well as Brazil and Mexico. They are characterized by average, compared to developed countries, wages, growing retail trade and household consumption, as well as dynamically growing GDP annually.

High and very high levels of consumption are observed in the EU-25, as well as highly developed countries (USA, Canada, Japan, Australia, Korea), where

a significant amount of average wages allows the population to increase household spending on goods and services, which, accordingly, constantly revives the physical volume of retail trade and restrains price growth.

Table 3. Grouping of countries by goods and services consumption level in 2017

Groups of countries	Consumption level	Integrated indicator *Y*	Countries
I	very low	< 0.3	Belarus, China, India
II	low	0.3-0.4	Azerbaijan, Tajikistan, Ukraine
III	average	0.41-0.5	Armenia, Bulgaria, Brazil, Czech Republic, Hungary, Kazakhstan, Latvia, Lithuania, Mexico, Poland, Uzbekistan
IV	high	0.51-0.6	Belgium, Greece, Israel, Korea, Spain, Portugal
V	very high	> 0.6	Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Switzerland, Sweden, United Kingdom, USA

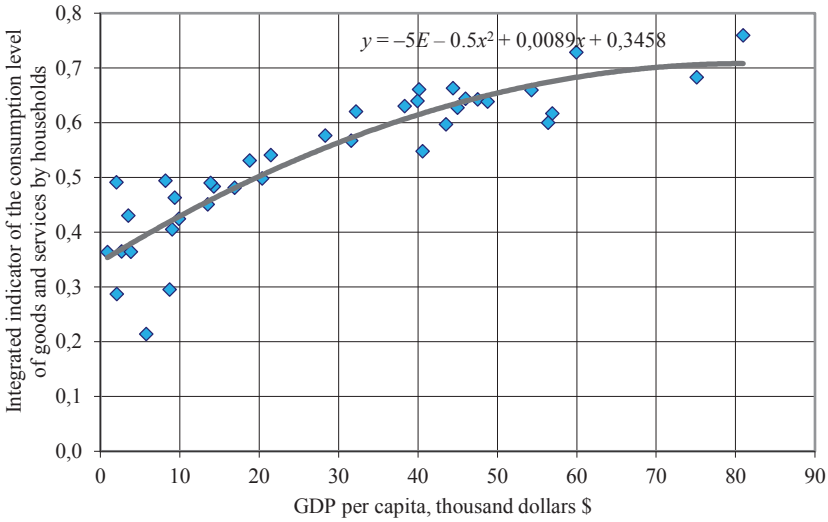
Source: calculated by the authors.

The grouping is confirmed by the analysis of the structure of consumption of goods and services in the countries of the world. In developed countries (Austria, Germany, Denmark, the Netherlands, Norway, Great Britain, Switzerland, Sweden, Canada, USA) the share of expenditures on food and soft drinks is only 5.8-8.0%. Compared to other countries, housing and communal services, electricity, water and gas supply are quite important. Expenditures on various goods and services are also much higher (12-17%) in these countries, which stimulates retail trade and services.

The population of Group IV countries (Belgium, Greece, Spain, Portugal, Korea) spends more on health care, education, use of hotel and restaurant services. In households of countries with an average level of integrated consumption (Bulgaria, Latvia, Lithuania, Poland, Hungary, the Czech Republic, Brazil, Mexico) have a significant share (14-21%) of expenditures on food and soft drinks, less – on the use of hotel services and restaurants, purchase of goods and services. For countries of groups I and II, the costs of food and housing and communal services are even higher.

The obtained grouping results show the uneven level of consumption of goods (services) in countries, which depends on the country's GDP, population size and standard of living, which limits the ability to purchase material goods and, therefore, limits entrepreneurial activity. A growing polynomial relationship between the country's GDP per capita and the integrated indicator of the level of consumption of goods (services) by households was revealed (Fig. 3).

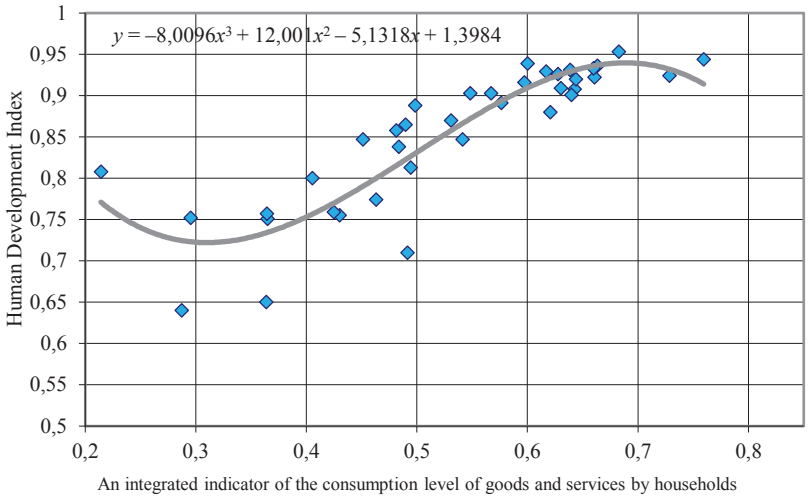
Fig. 3. Relationship between the country's GDP per capita and the integrated indicator of the level of consumption of goods (services) by households



Source: calculated by the authors.

Analysis of the structure and volume of consumption in the global dimension revealed the dependence of the Human Development Index, which characterizes the level of quality of life, literacy, education and longevity as the main characteristics of human potential from the integrated indicator of consumption of goods

Fig. 4. Relationship of the integrated indicator of the level of consumption of goods and services with the Human Development Index, 2017



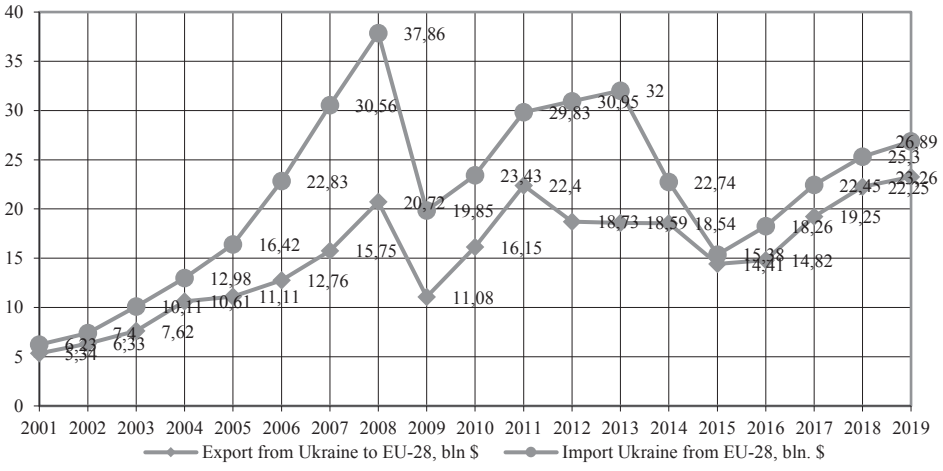
Source: calculated by the authors.

and services (Fig. 4). The highest integrated level of consumption observed in Switzerland, the United States and Norway is accompanied by the highest indicators of the Human Development Index – 0.944, 0.924 and 0.953, respectively. The second group includes countries with high levels of consumption (Australia, Austria, Belgium, Great Britain, Denmark, Canada, Korea, Germany, the Netherlands, Portugal, Finland, France, Sweden, Japan), which ensured a high level of their socio-economic development and, therefore, high values of the Human Development Index (0.88-0.94).

Countries with low, medium and partially high levels of consumption is characterized by a significant interval of the Human Development Index: for Hungary, Lithuania, Latvia, Poland, the Czech Republic – 0.85-0.9; Belarus, Armenia, Azerbaijan, Kazakhstan, Uzbekistan – 0.75-0.8. In Ukraine, unfortunately, there are low levels of the integrated indicator of the level of consumption and the Human Development Index.

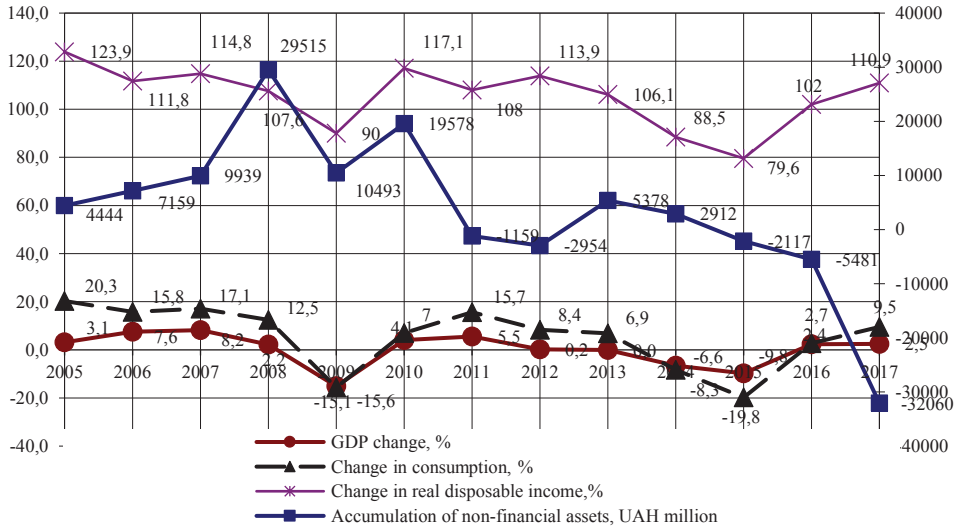
It should be noted that the importance of consumption safety research for our country is conditioned by the fact that consumption is the main element in the structure of GDP, it accounts for the largest share of all costs incurred by economic entities. The share of final consumer expenditure of households in the structure of GDP has increased significantly over the past 18 years: from 56% in 2001 to 66.3% in 2017, with the highest value in 2013 – 71.4%. Considering the permanent growth of the share of trade transactions with EU countries (Fig. 5), it is important to strengthen consumption safety in Ukraine in the context of European integration.

Fig. 5. Foreign trade between Ukraine and the EU-28, 2001-2019



Source: calculated by Trade Map 2020.

Fig. 6. Relationship between changes in consumption and GDP and disposable income and accumulation of non-financial assets of the population of Ukraine, 2005-2017

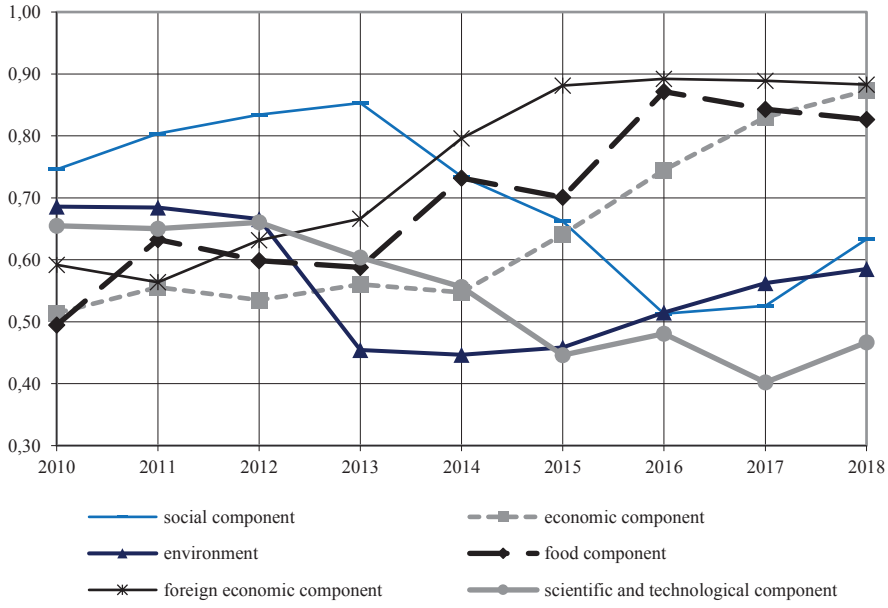


Source: calculated by the authors.

Consumption is one of the most dynamic components of GDP, and the rate of change always correlates with the rate of change in GDP and is always higher. At the same time in the crisis of 2009 the rate of decline in consumption (–15.6%) corresponded to the rate of decline in GDP (–15.1%), and in 2014 and 2015 were –8.3% and 6.6% and –19.8% and –9.8%, respectively (Fig. 6). During the crisis in Ukraine, there was a change in consumer behavior in the food market, the population rationalized consumption, abandoning low-energy products in favor of high-value [Shkvarchuk 2012: 325]. In the crisis of 2015, there was an even greater decline in consumption of all products without identifying their value. It can be argued that in Ukraine a special model of GDP structuring has been formed, in which the share of consumer expenditures in various forms is dominant and the potential for economic growth is practically not formed.

Considering the recent events related to the coronary crisis, we note the high probability of changes in consumer preferences and attitudes, in particular due to the changes in income and employment. If during the quarantine period the volume of demand has decreased to the size of the needs for basic necessities, at the stage of weakening the pandemic measures it is possible to increase it due to delayed needs, while further positive dynamics may slow down due to caution and social distance. Thus, according to [Felsted 2020] we can identify the following areas of influence on the structure of consumption: reducing total consumption, cost savings and pragmatization of consumption, increasing the

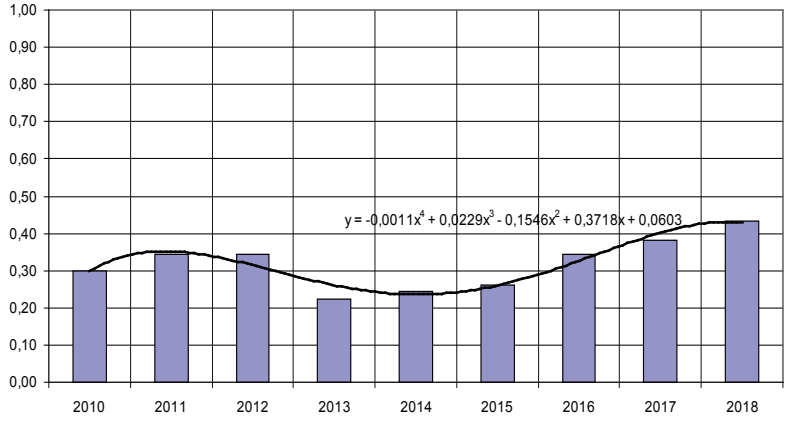
Fig. 7. Dynamics of change of taxonomic indicators of consumption safety by functional components, 2010-2018



Source: calculated by the authors.

share of shopping in online stores, reducing demand for everything that involve social contacts, increasing demand at points of sale "near the house". According to experts [*Where next…* 2020], such trends may demonstrate not only a change

Fig. 8. Dynamics of change in the taxonomic indicator of consumption safety in Ukraine, 2010-2018



Source: calculated by the authors.

in consumer preferences, but also the formation of a new culture of consumption, in particular within virtual consumption.

Analysis of the situation of consumption safety in Ukraine by a set of criteria and indicators, grouped by functional components (Fig. 7), showed a low level, which since 2016 on some foreign and domestic economic and food indicators is improving slightly (Fig. 8), but remains quite low on areas that form the social basis of human existence (living conditions, work, health).

3. Conclusions

According to the research results, the uneven distribution of the level of consumption in the countries of the world, which is determined by the volume of the country's GDP, the number and the level of quality of life of the population, was established. It was proved that consumption safety is largely determined by the financial capacity and level of welfare of the population (growth rates of savings, real disposable income, accumulation of non-financial assets). The relationship between the dynamics of change in consumption with economic growth due to the dominance of consumption in the structure of Ukraine's GDP was demonstrated.

In summary, it should be noted that consumption safety motivates and, at the same time, limits consumers, intermediaries, producers and the state to economic interests, which necessitates their harmonization in the production and consumption of goods (services). Thus, we can consider that consumption safety will promote the convergence of Ukraine's economy with EU member states on the basis of sustainable development.

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Analiza konsumpcji w procesie zrównoważonego rozwoju – aspekt regionalny

Streszczenie. *Autorzy proponują syntetyczny wskaźnik do klasyfikacji krajów pod względem poziomu konsumpcji. Wskaźnik wskazuje na nierównomierny rozkład konsumpcji na świecie, na który wpływa PKB, liczba ludności i jakość życia w analizowanych krajach. Autorzy badaj zależności między syntetycznym wskaźnikiem poziomu spożycia dóbr (usług) przez gospodarstwa domowe a poziomem PKB na mieszkańca oraz wskaźnikiem rozwoju społecznego (HDI). Przedstawiają także korelacje między poszczególnymi wskaźnikami zdolności finansowej i poziomu dobrostanu ludności a wskaźnikami poziomu spożycia. Ta analiza taksonomiczna służy do określenia poziomu konsumpcji na Ukrainie.*

Słowa kluczowe*: jakość życia, poziom spożycia, PKB, wskaźnik rozwoju społecznego*

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Management of the development of territorial communities in Ukraine under the assets-based approach

Abstract. *Each territorial community (amalgamated community) in Ukraine has its own resource base, but its successful development depends not only on the availability of resources, but also on the ability to turn them into development assets. Therefore, when talking about managing the assets of territorial communities, one should focus on two aspects: the community's own resource base of and its effective management with a view of transforming this resource into a community asset. The purpose of the article is to compare conceptual approaches to management with emphasis on asset-oriented management of a territorial community. The study involves historical, abstract and logical, systematic and comparative analysis. The authors analyse different conceptual approaches to management, making comparisons and highlighting opportunities and expediency of their application for the purpose of managing territorial communities. The goal of asset-oriented management is to increase the community's capacity by mobilizing its own resources and transforming them into development assets. The authors identify various types of community assets and classify them into tangible and intangible ones. They also propose the framework of asset management in territorial communities, including stages of management, its purpose, subjects and objects of management as well as interconnections.*

Keywords: *assets, asset-oriented management, capability, management, territorial community, amalgamated community*

1. Introduction

The ongoing administrative-financial decentralization reform in Ukraine and change of the regulation vector towards the self-development of territorial communities and their economic growth have raised the new requirements to the

research of territorial communities as entities and objects of economic relations that manage the development of their territories. Any territorial community has a certain resources capacity – natural, financial, human, entrepreneurial, etc. Yet the success of a community's development depends not only on available resources but also on their capacity to turn them into the development assets that should secure the growing capitalization of territories and their residents' wellbeing. Speaking about the management of territorial communities' assets, it is worth paying special attention to two aspects: the resources capacity of a territorial community and efficient management directed at transforming the resource into the community's asset.

2. Analysis of recent research

Change of public regional policy's accents to the endogenous factors of communities' development has become the ground for the introduction of the assets-based management of territorial communities in Ukraine. The methodology of communities' sustainable development based on strong and perspective opportunities that are in the heart of the assets-based management is developed by J.P. Kretzmann and J.L. McKnight [1993], while the management of the resources capacity at the level of territorial communities – by E. Ostrom [2010: 20]. Among the domestic researchers, substantial theoretical contribution to assets-based management is made by M.V. Ilyina [2018: 53], M.V. Ilyina, Y.B. Shpylova [2018: 76], O.Y. Bobrovska [2018: 2], H. Monastyrskyy [2008: 141], V.V. Pylypiv, L.P. Tychkovska, [2013: 72], V.V. Lavrenenko [2013: 142], etc. However, the implementation of the assets-based approach to the management of territorial communities is quite new and poorly substantiated for domestic science and practice, therefore, it requires a more thorough theoretical and practical substantiation.

The paper aims to compare conceptual approaches to management with emphasize on the assets-based management of a territorial community.

3. Main research findings

3.1. Methodological approaches to the management of the development of territorial communities

There are various methodological approaches to the management of the development of territorial communities in domestic and foreign research. They conceptually focus on various driving forces and values, and they have different

goals and orientation. The most widespread conceptual approaches to the management of territorial communities are resource-based, problem-based, assets-based, and values-based approaches (Table 1; 2). The provisions of these conceptual approaches are interrelated, they have gone through certain evolution stages and have many controversial issues. The researchers outline the main tasks of the resources theory and values- and cost-based approaches, in the first place, in the context of business management. However, under the administrative-territorial decentralization and shifting accents to the endogenous development of territorial communities, it is important to outline the tasks of these conceptual approaches to management projected on a territorial community.

H. Monastyrskyy [2008: 143] have made significant contributions to the research of territorial communities. They consider territorial communities as corporate structures that can have a bank account, cooperate with authorities, issue and participate in operations on the securities market, have the shares in the assets of business entities.

O.Y. Bobrovska [2018: 2-10] examines in her studies the resources theory projected on the development of a territorial community. The author outlines the main tasks of the resource-based approach to the planning of territorial communities' development to use it in the course of strategies and plans development and implementation. Based on the research of the resources composition and structuring, she allocates the following types at the level of territorial communi-

Table 1. Identification of conceptual approaches to the management of territorial communities

Conceptual approach	Goal	Orientation	Social intercourse	Financial benchmarks
Problem-based management	problem solution	community's needs	weak	problem elimination costs
Resource-based management	growing competitiveness	optimal composition of resources	strong	growing financial result due to competitive advantages
Values-based management (stakeholder theory)	achievement of stakeholders interests balance	interests of various interested parties	strong	financial interests of stakeholders
Value (cost)-based management (capitalization)	growing cost	interests, values of owners	weak	getting the added value
Assets-based management	**transforming the resource into the assets**	**strengths and opportunities of the community**	**strong**	**forming of capital**

Source: developed based on: Penrose 1995; Rumelt 1974; Barney, Ketchen, Wright 2011; Rokeach 1979; Porter 1980; Gutman 1982; Rappaport 2000; McTaggart, Kontes, Mankins 1994; Kretzmann, McKnight 1993; Ilyina, Shpylova 2018: 76; Bobrovska 2018: 2.

Table 2. Projection of conceptual approaches to management on the level of a territorial community

Conceptual approach	Approach orientation	Nature of the approach	Representatives	The concept projection on the level of a territorial community
Resource-based approach (resources theory)	To transform resources into the competitive advantages	The nature of the theory is that possession of the unique resources and organizational skills to use them efficiently rather than the products or market segments are the advantage. With the accumulation of resources, the emphasis turns to an individual.	RBV-resource-based view E. Penrose, R. Rumelt, J. Barney, D.J. Ketchen, M. Wright, etc.	Territorial community has all the types of resources, is responsible for their rational use, optimal combination, and increase of their resources.
Values-based management (stakeholder theory)	Interests of all stakeholders	Creation of values in the system of achievement of "the interests balance" for all stakeholders. Therefore, a value will be the complex and multidimensional category, sometimes even controversial because it will absorb opposite interests	M. Rokeach, M. Porter, J. Gutman, etc.	Management of a territorial community should take into account the interests of all stakeholders – residents, property owners, service users, investors, authorities of various levels, entrepreneurship sector, NGOs
Value (cost)-based management	Cost increase for owners	The concept is based on recognition of the fact that value growth for business owners is its main financial goal. All managerial decisions should be directed at achievement of the goal.	A. Rappaport, J.M. McTaggart, P.W. Kontes, M.C. Mankins, etc.	The concept is rather applied at the company level and is oriented at financial result. It does not take into account the interests of all stakeholders of a territorial community
Assets-based management	Transforming a resource into the asset	It is important to find strengths and resources, and to turn them into assets able to directly or indirectly generate the monetary flows and income	Asset-based community development J.P. Kretzmann, J.L. McKnight	The community can be successful only in case the resource is turned into an asset. It is important to reorient the community on the search for strengths.

Source: developed based on: Penrose 1995; Rumelt 1974; Barney, Ketchen, Wright 2011; Rokeach 1979; Porter 1980; Gutman 1982; Rappaport 2000; McTaggart, Kontes, Mankins 1994; Kretzmann, McKnight 1993; Ilyina, Shpylova 2018: 77; Bobrovska 2018: 2; Ilyina 2018: 53.

ties: material, natural, material-productive, and physical resources of economic entities and citizens, financial and non-material resources – social, institutional, administrative, human, knowledge-based, informational, intellectual, innovative, organizational, communicative (resources of relations), and time resources.

Elinor Ostrom has contributed substantially to the research of territorial communities in the context of resource capacity management. In 2009, she was awarded the Nobel Prize for economics "for her analysis of economic

governance" and research of the ways the territorial communities rather than governments or private companies can successfully manage the common resources [Ostrom 2010: 20]. Through her empirical research on the use of social resources all over the world, she has confirmed the efficiency of local communities in social resources management. The main feature of E. Ostrom's methodological approach is that unlike the theories of public and private management, the best condition of social resources is secured by the users of common resources that have the long-term interest in their preserving and multiplying, thus investing in monitoring and confidence-building. In time, the territorial communities find and approve the rules of efficient use of resources. On the other hand, the total transfer of common benefits to the state is a bad alternative. The bureaucratic system of social resources management stipulates the decisions centralization; it alienates the management coordinator from the final consumer. Such public decisions cannot be adequate because the rules imposed downward are usually poorly related to specific local needs and ignore the views of direct resources consumers. Private property, which used to be considered the most efficient way to use social benefits by the market liberalism supporters, often leads to excessive use of resources and their exhaustion. Moreover, it leads to a range of social problems related to local communities. They become alienated from the use of benefits that have been considered common and no one's at the same time for centuries.

Therefore, the key managerial decisions should be made at the bottom level by the participants of territorial communities; the territorial community can manage its resource capacity efficiently; the efficiency of using resources depends on the community's capacity to self-organize and self-regulate; the results of social benefits generation depend less on the ownership form than on the rules that regulate the generation and use of social benefits.

Mixed interpretation of value has led to the emergence of two different research directions within the value-based concept: value (cost)-based management and relatively independent theories devoted to the role and mechanisms of value creation, including the mechanisms of values creation in the system of achieving the "balance of interests" for all stakeholders of the company (excluding owners, wage-workers, authorities, state, suppliers, consumer, scientific institutions, banks, etc.).

Value (cost)-based management aimed at increasing value (shareholder value) for owners is oriented at an enterprise. The process of cost generation, management for value, and value assessment are its aspects. It is not reasonable to project this approach to the level of a territorial community because, in the first place, it is difficult to assess the cost of a territorial community and cost growth, and in the second place – not all community residents are the owners of its assets.

The second approach is more acceptable in the context of the development of the territorial community – the mechanism of creating value for all stakeholders. In this case, the value will be a complex category, the multiple-level one, while sometimes controversial due to absorbing the opposite interests. For example, the community residents are interested in the sustainable use of natural resources, while entrepreneurial structures located at the community's territory strive for their maximum exploitation. In our opinion, the process of identification of stakeholder groups for a territorial community, needs and interests of each group, their impact on managerial decision-making are very complex as well.

The development of the resources theory focused on the resource- and competitive advantages-based growth brings about the emergence of the key competencies and dynamic organizational skills concept, which substantially expands the resources interpretation as an economic category by adding the internal elements. The researchers use the terms "competencies", "skills", and "routines" when analyzing their nature and relationships. They conclude that the resources themselves are not efficient. Only available organizational skills and key competencies to carry out business processes and use resources become the basis of competitive ability [Lavrenenko 2013: 142]. In the context of the development of territorial communities, the emphasis is put on human capital and the use of community development peculiarities – traditions, relations, leaders' organizational skills, etc.

In projecting the concept of resource advantages and asymmetry on the development of a territorial community, it is important to find resources, which the competitors do not possess, i.e. the so-called "asymmetries". The advantages-assets not owned by competitors, which cannot be easily copied or purchased on the market are the sources of the asymmetry. Such resources-assets should be of strategic nature for a territorial community. Therefore, modern concepts of the resources theory for territorial communities are based on the ability to find unique resources and to turn them into assets.

3.2. Asset-based community development

The new concept of the assets-based community development elaborated by J.P. Kretzmann and J.L. McKnight should be considered as an important conceptual approach to the development of territorial communities in the context of modern regional-financial policy in Ukraine [Kretzmann, McKnight 1993]. The main feature of the approach is the orientation on the use of own resources of the community, relationships, and turning them into assets of the mobilization instruments use. Scientists and experts connect assets in their direct understanding with an enterprise and accounting (capital assets, work-

ing capital, other assets), yet most often, they are interpreted as resources controlled as the result of past actions, the use of which will predictably lead to economic benefits in the future. The researchers emphasize the role of assets in the capacity to directly or indirectly generate cash flows and income in one form or another.

The delineation of assets and liabilities by the cash flows direction is quite simple: assets are the property that generates income, while liabilities reduce it, according to R. Kiyosaki [2004]. The authors consider the property granted on lease, equities, deposits, and royalties as assets, while the rented property and all types of credits and debts are considered the liabilities. H. de Soto also attributes assets to capital and argues that the latter emerges due to its specification in the property rights and pledge records, contracts, and other documents, where social and economic features of the asset are registered [Soto 2017]. Therefore, the difference between asset and capital lies in the ratio between the control and property rights: in the first case, the capacity of an entity to carry out control is a more important feature, in the second case – to have the property right.

Domestic scientists M.V. Ilyina and Y.B.Shpylova examine the assets at the level of rural communities and interpret the assets of rural areas as an aggregate of economic resources (natural, labour, financial, intellectual, informational) and opportunities to use them within a certain territory. They divide assets into infrastructural, social, and natural) [Ilyina, Shpylova 2018: 77]. The researchers emphasize the human capital as the most important asset, yet they place infrastructural assets at the top of the pyramid of rural areas' assets. It is also worth mentioning their approach to determining the community type based on available assets and opportunities to use them.

3.3. The classification of territorial communities' assets

Taking into account the peculiarities of the territorial community's development as a socio-economic system and social community at the same time, it is worth allocating material and non-material assets in the classification of territorial communities' assets. It should be noted that the same asset can be the combination of both material and non-material assets. For example, a school of a territorial community as a building is a social infrastructure asset, while the school team is a non-material asset of an associative type (Fig. 1).

In the context of territorial communities' development, the assets-based approach to management is aimed at strengthening the territorial communities' capacity (Fig. 2). The following are the components and stages of the assets-based management: identification of available material and non-material assets (natural resources, infrastructural, entrepreneurial, historical-cultural, human capital, etc.); forming of the map of territorial communities' assets with deter-

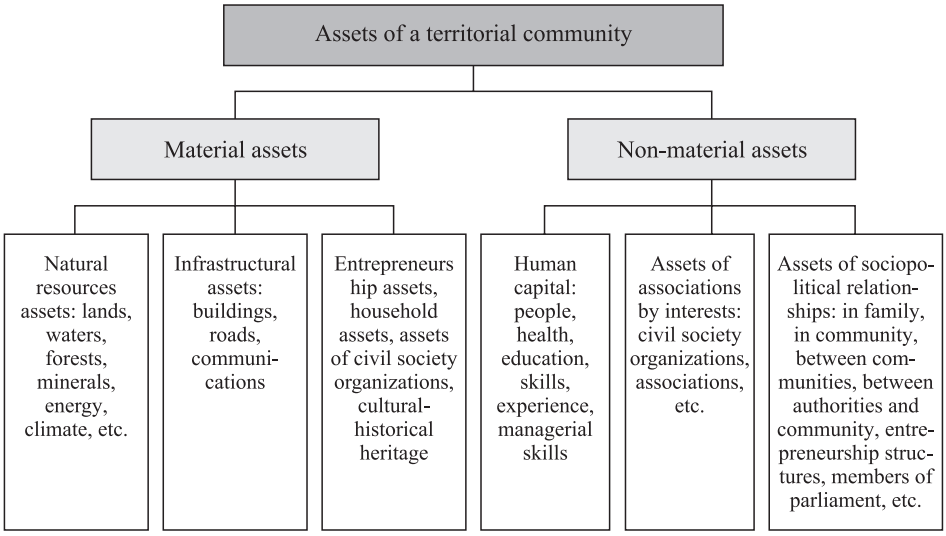

Fig. 1. Types of territorial communities' assets

Source: developed by the authors

mining their volumes and linkages and with further outlining of advantages and strengths; defining priority directions of a territorial community's development following the assets-based approach; forming of the strategy and programs of a territorial community's development and their coordination with regional and national strategies and programs; monitoring of the use of assets and growing capacity of a territorial community; specification of the additional need to attract and activate resources.

4. Conclusions

Therefore, in conditions of the administrative-financial decentralization and shifting focus towards the self-development of territorial communities and the maximum use of their capacity, the need and opportunity to use the assets-based approach to the management of territorial communities and to secure their capacity on this basis become of the utmost importance. The research of the assets-based management of the territorial community contributed to revealing its following features:

– the aim of the management is to strengthen the capacity of territorial communities following the assets-based approach;

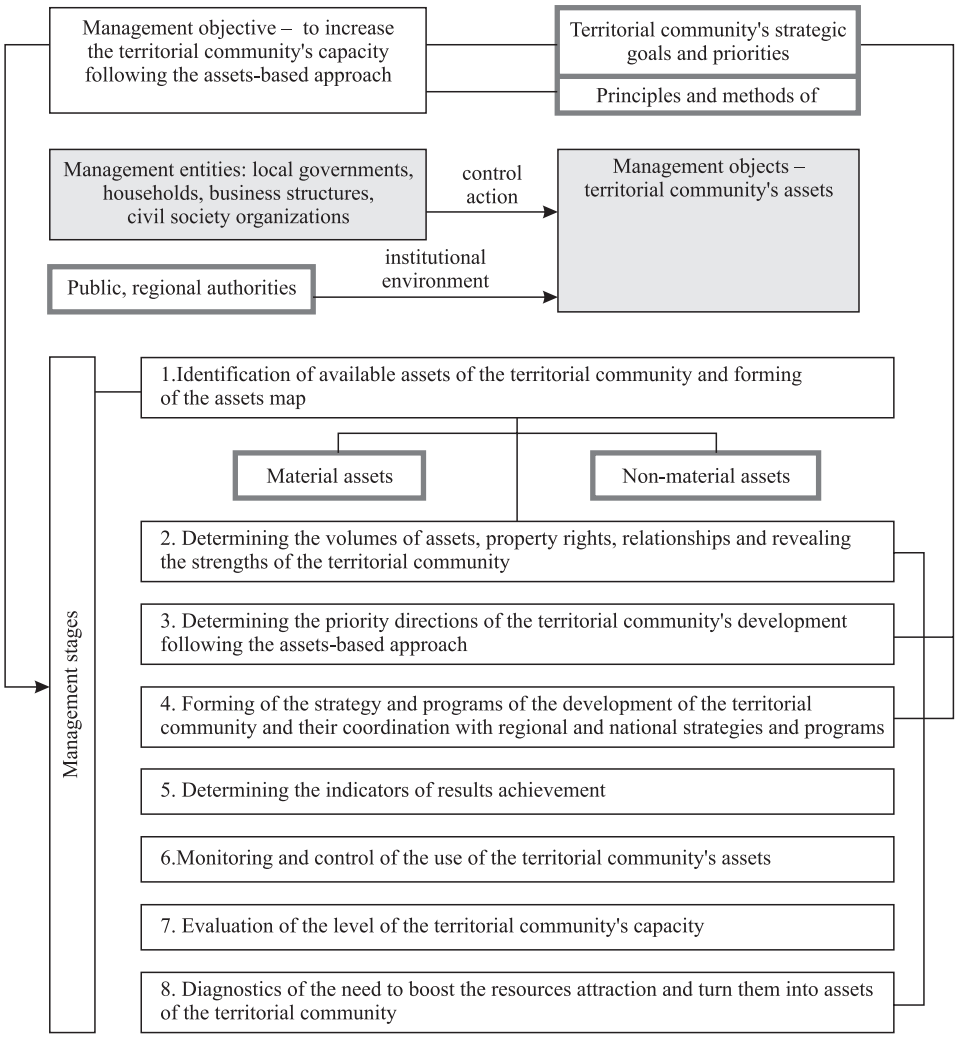

Fig. 2. Technology of the assets-based management of a territorial community

Source: developed by the authors.

– availability of identified owner, quantitative and qualitative assessment of the asset's cost, and its use are the features of the territorial community's assets that should directly or indirectly impact the integral indicator of the territorial community's development;

– the feature of the use of the assets-based management at the level of the territorial community is that the community's assets shouldn't be identified with the enterprises' assets, i.e. it is important to avoid accounting approach to determining

of assets. Many resources-assets of the territorial community may lack the material basis, yet secure the strategic nature of its development, while maintaining the competitive ability, namely the human capital, social assets, historical-cultural heritage, family, community, etc.;

– internal and external linkages of the territorial community shouldn't be underestimated as they are the important asset of the community development as a social community. It is necessary to take into account the interests of all stakeholders of the territorial community, to reveal their motivation capacity and impact on making the managerial decisions, and to examine the readiness of the territorial community's members to direct their funds to common development.

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Zarządzanie rozwojem wspólnot terytorialnych na Ukrainie w ramach podejścia opartego na aktywach

Streszczenie. *Każda (zjednoczona) wspólnota terytorialna na Ukrainie posiada własną bazę zasobów, ale jej pomyślny rozwój zależy nie tylko od dostępności zasobów, ale także od umiejętności przekształcenia ich w aktywa rozwojowe. Dlatego też mówiąc o zarządzaniu zasobami wspólnot terytorialnych, należy skupić się na dwóch aspektach: własnych zasobach wspólnoty oraz na efektywnym zarządzaniu zasobami w celu przekształcenia ich w aktywa wspólnoty. Celem artykułu jest porównanie różnych podejść do zarządzania, ze szczególnym uwzględnieniem zarządzania zorientowanego na aktywa w odniesieniu do wspólnot terytorialnych. Badanie obejmuje analizę historyczną, abstrakcyjną i logiczną, systematyczną i porównawczą. Autorzy analizują różne podejścia do zarządzania, dokonując porównań oraz podkreślając możliwości i celowość ich stosowania w zarządzaniu wspólnotami terytorialnymi. Celem zarządzania zorientowanego na aktywa jest zwiększenie możliwości wspólnoty poprzez mobilizację jej własnych zasobów i przekształcenie ich w aktywa rozwojowe. Autorzy identyfikują różne typy aktywów i dokonują ich podziału na materialne i niematerialne. Proponują także koncepcję zarządzania aktywami wspólnoty terytorialnej, obejmującą etapy zarządzania, jego cel, podmioty i przedmioty zarządzania oraz wzajemne powiązania.*

Słowa kluczowe*: aktywa, zarządzanie zorientowane na aktywa, zdolność, zarządzanie, zjednoczona wspólnota terytorialna*

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A study of the cycle of electricity consumption and production in Ukraine using the Monte Carlo method

Abstract. *The article presents a study of the Ukrainian electricity sector using by the Monte Carlo method. The authors designed a simulation model to forecast electricity production in Ukraine. The following indicators were taken into account in the model: predicted consumption intervals for all consumer groups; medians and standard deviations of electricity consumption intervals; average percentage of (net) electricity consumption relative to total electricity generation. The result of the simulation is the value of total electricity production in Ukraine in November 2019. This simulation study indicates a high degree of confidence in the short-term forecasting of electricity production.*

Keywords*: electricity market, simulation model, Monte Carlo method, forecasting electricity production, pessimistic and optimistic forecasts, consumer and production cycle, the structure of consumption*

1. Introduction

At present, Ukraine has a sufficient level of energy capacity, which is based on the production, distribution and sale of electricity and heat. The main problem

of the electricity sector is a certain unstable and uncertain political activity of the state apparatus, which in turn has some impact on foreign direct investment, however, it should be noted that the electricity sector is currently one of the most attractive investment.

2. Modeling the behavior of the electricity sector of Ukraine by the Monte Carlo method

One of the most important areas of research and analysis of the electricity sector is the economic balance of electricity. The concept of the balance of the electricity market of Ukraine is based on the concept of such a market state, which is characterized by the equality of the amount of electricity consumption in the power system, its own costs, electricity losses in electricity grids relative to the total amount of electricity generation in the power system, taking into account the flows of electricity with other energy systems.

In order to predict the stable situation in the electricity market of Ukraine, we propose to use simulation methods. One of such methods is the Monte Carlo method, which is widely used in various areas of economics to predict and reproduce the behavior of real phenomena and objects. Its structure includes a combination of components such as the sensitivity analysis and the analysis of the probability distribution of input factors. This method allows you to create a model with data minimization, as well as to maximize the values of input data used in the model [Zhelezko, Artemyev, Savchenko 2003; Kosobutskyy 2014].

In order to model the behavior of the electricity sector of Ukraine by the Monte Carlo method, it is necessary to analyze the total structure of electricity consumption by different groups of consumers (Fig. 1).

The simulation model will be based on forecasting electricity consumption (net) due to the following input factors – the dynamics of electricity consumption by industrial, agricultural, transport complexes, as well as the dynamics of electricity consumption by consumers (household and non-industrial consumers, people – Tab. 1). The simulation method is used to make up the power consumption scenarios for 1 month, November 2019.

In order to build the simulation model, we calculated the following indicators [Binder, Heerman 1982]:

– predicted consumption intervals of all consumer groups – pessimistic and optimistic forecasts;

– the median of the intervals of electricity consumption;

– the standard deviation;

– average percentage of electricity consumption (net) relatively to total electricity generation.

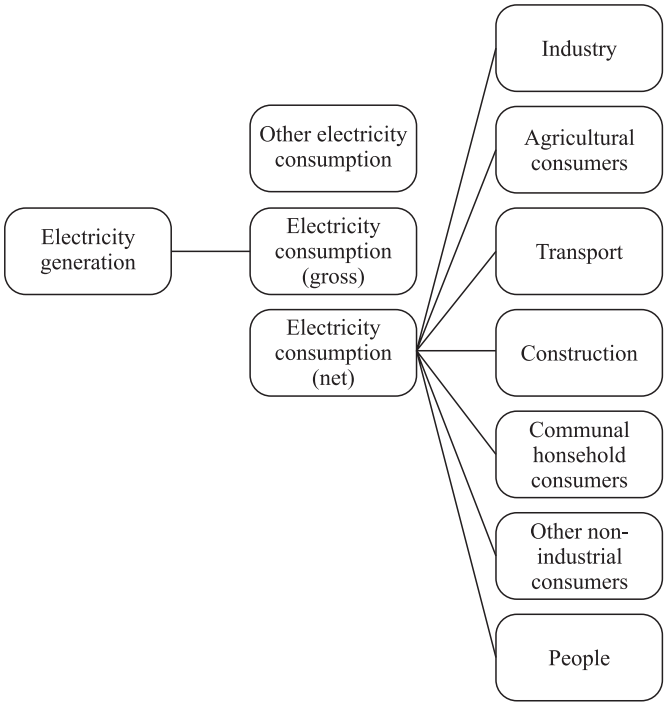


Fig. 1. The structure of consumption of the electricity market of Ukraine

Source: compiled by the authors.

At the first stage we made up pessimistic and optimistic forecasts for all groups of electricity consumption:

– formula for calculating the seasonality factor – *K* for the relevant group of consumers (industry):

$$K = ((B2 : B13) / SUM (B2 : B13)) \times 12.$$

– based on the calculated seasonality coefficients – *K* we found the projected values of electricity consumption of the industrial sector for a particular period – four months (since November 2019 – *E Nov*. till February 2020), which presents the formula – the calculation of the projected value for November:

$$E\ Nov. = \text{Forecast } (A24; \$B\$2: \$B\$23; A2 : A23) \times \\ \times \text{ Index } (\$F\$2: \$F\$13; \text{Month } (A24)).$$

– the next step is to calculate the standard deviation – σ for the predicted values of the power consumption of the industrial complex by the formula:

$$\sigma = \text{Confidence } (0.05; STDEV (C24 : C27); \text{Count } (C24 : C27)).$$

Table 1. Dynamics of electricity consumption by consumer groups

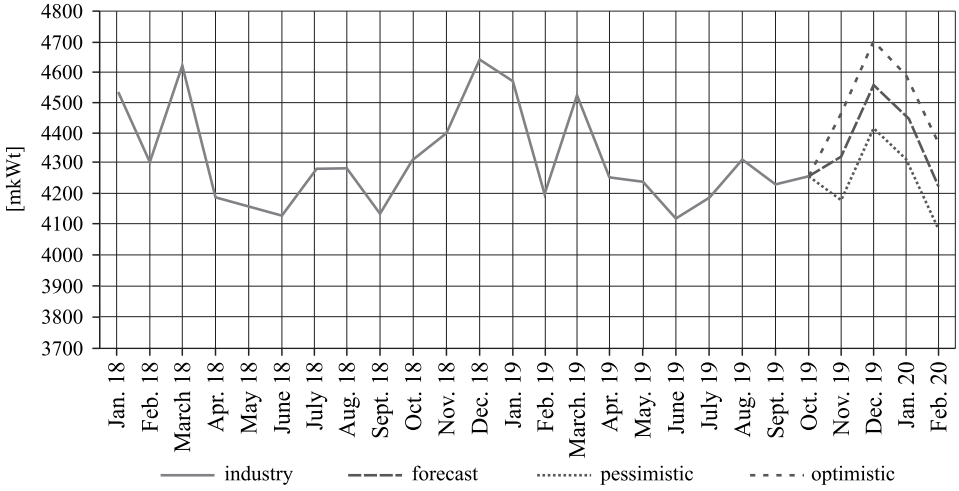
Month	Consumer groups, million kilowatt						
	Industry	Agri-cultural consumers	Transport	Construc-tion	Communal household consumers	Other non-industrial consumers	People
Jan.18	4536,1	301,2	655,5	93,7	1483,1	628,5	3660,3
Febr.18	4310,8	297,4	615,2	106,3	1495,0	688,2	3284,0
March18	4618,9	288,6	676,9	101,4	1463,0	663,0	3613,2
Apr.18	4194,1	259,0	553,7	81,4	1195,2	559,0	2753,3
May18	4162,6	329,9	509,5	59,9	1080,5	460,6	2552,1
June18	4128,5	371,8	509,7	60,4	1135,5	482,1	2465,3
July18	4279,0	352,0	530,6	60,8	1155,4	482,6	2582,1
Aug.18	4286,1	379,9	523,6	64,0	1216,5	520,3	2626,9
Sept.18	4139,3	285,1	516,0	63,3	1133,5	490,9	2487,7
Oct.18	4324,6	315,0	560,8	70,3	1137,9	504,6	2911,7
Nov.18	4402,7	342,1	626,5	90,7	1399,8	626,9	3348,4
Dec.18	4640,5	345,8	677,0	112,3	1611,1	773,3	3661,8
Jan.19	4565,9	335,0	672,1	103,3	1652,8	753,2	3741,5
Febr.19	4193,6	295,3	590,3	107,8	1468,7	731,3	3219,3
March19	4517,2	274,9	590,2	92,4	1375,1	667,8	3272,2
Apr.19	4251,9	257,7	543,5	81,3	1158,1	586,2	2912,4
May19	4242,3	278,5	488,4	75,5	1067,0	488,7	2532,1
June19	4123,5	341,2	521,0	66,3	1169,9	528,6	2728,9
July19	4187,7	356,8	517,9	66,1	1125,0	554,4	2542,3
Aug.19	4312,0	326,7	483,8	62,4	1132,8	551,5	2500,8
Sept.19	4239,0	275,1	474,9	66,3	1164,5	520,2	2549,1
Oct.19	4263,9	318,3	543,0	69,5	1168,7	554,9	2926,1

Source: The Ministry of Energy of Ukraine, *Information about the work of the power complex from 01.01.2019 to 31.10.2019*, http://mpe.kmu.gov.ua/minugol/control/uk/publish/officialcategory?cat_id=245183225 [accessed 14.11.2019]; Unified state web portal of open data, *The structure of electricity consumption in Ukraine from 01.01.2019 to 31.10.2019*, https://data.gov.ua/dataset/7d78eb81-dfad-4d1a-aa2e-797e93024206 [accessed 14.11.2019].

– at the final stage, we found pessimistic and optimistic forecasts for the probabilistic values of electricity consumption by the industrial complex, which are calculated by the formulas:

$$E\,(Nov\,/\,pes) = E\,Nov - \sigma,$$
$$E\,(Nov\,/\,opt) = E\,Nov + \sigma.$$

Fig. 2. Projected data of consumption volumes of electricity by the industrial complex of Ukraine



Source: compiled by the authors.

Graphic representation of pessimistic and optimistic forecasts of electricity consumption for four months – since November 2019 till February 2020 for the industrial complex is shown in Fig. 2.

Projected data of the value of electricity consumption of the industrial complex:

– November 2019 in million kWt (forecast – 4321,992, pessimistic – 4181,951, optimistic – 4462,033);

– December 2019 in million kWt (forecast – 4556,014, pessimistic – 4415,973, optimistic – 4696,056);

– January 2020 in million kWt (forecast – 4452,792, pessimistic – 4312,751, optimistic – 4592,833);

– February 2020 in million kWt (forecast – 4231,459, pessimistic – 4091,418, optimistic – 4371,5).

In order to start the process of simulating the results (scenarios), you need to calculate the median value and the standard deviation value for the input data (Tab. 2).

The calculation formula of the simulated value of power consumption of the industrial complex will look like in Microsoft Excel software:

$$I = NORM.INV\ (RAND\ ();\ \$E\$2;\ \$F\$2).$$

Function – *NORM.INV* returns the inverse normal distribution for the specified average and standard deviation. The syntax of this function is *NORM.INV*

Table 2. Calculated values for input data for November 2019

Type of consumption	Intervals		Medians	Standard deviation
Industry	4181,951	4462,033	4321,992	85,13130699
Agricultural consumers	307,570	356,787	332,1783	14,95954407
Transport	530,560	579,465	555,0122	14,86471125
Construction	72,448	90,387	81,41765	5,452680851
Communal household consumers	1198,473	1353,759	1276,116	47,19939210
Other non-industrial consumers	558,037	692,650	625,3433	40,91568389
People	2866,929	3225,917	3046,423	109,1148936

Source: compiled by the authors.

(probability – *RAND* (); median – $*E*$2; standard deviation – $*F*$2), where the probability is equal to the normal distribution.

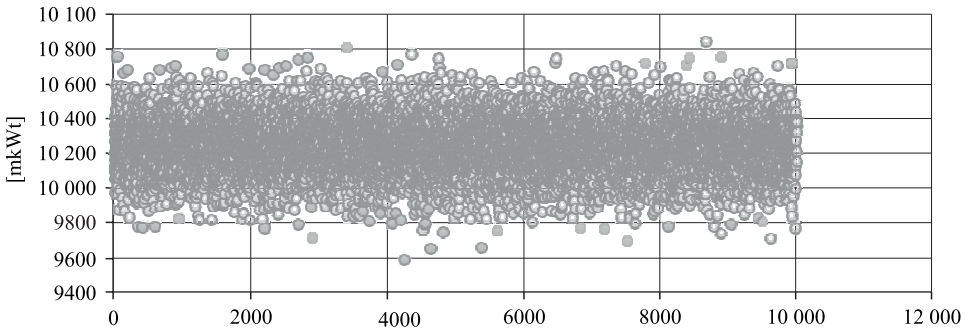
Let's represent the distribution of normal values of a random variable for consumption (net) of electricity by all types of consumers for November 2019, simulated using the Monte Carlo method [Kosobutskyy 2014] in Fig. 3.

The total results obtained for the 1st scenario out of 10,000 scenarios for all types of consumers are presented in Table 3.

It should be noted that the total net electricity consumption is the total electricity consumption by all types of consumers. Net electricity consumption is on average 77.72% of the total electricity production by the energy complex of Ukraine for the period since January 2018 till October 2019.

According to the results of the research – 10000 scenarios, you can make up intervals for simulated data of total electricity production – *R* in million kWt:

Fig. 3. Point distribution scheme of normal values of a random datum



Source: compiled by the authors.

Table 3. Estimated values of the first simulation scenario

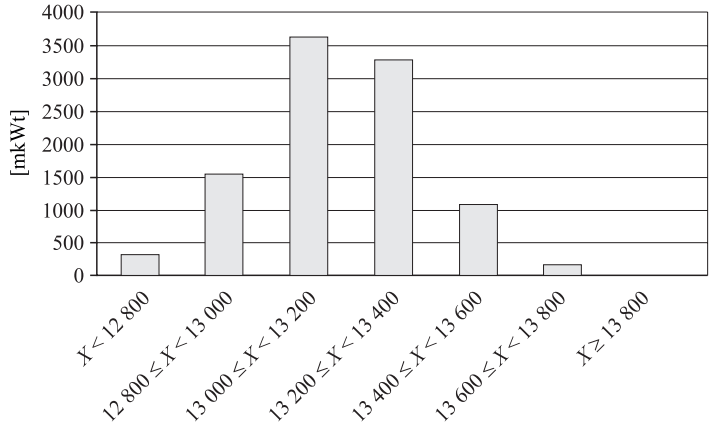
Type of consumer	The amount of electricity consumption in million kWt
Industry	4488,566
Agricultural consumers	311,613
Transport	546,534
Construction	76,726
Communal household consumers	1220,627
Other non-industrial consumers	643,954
People	3073,933
Total electricity consumption (net)	10361,950
Total electricity production	13332,160

Source: compiled by the authors.

– $R < 12800$ (313 scenarios);
– $12800 \leq R < 13000$ (1534 scenarios);
– $13000 \leq R < 13200$ (3632 scenarios);
– $13200 \leq R < 13400$ (3274 scenarios);
– $13400 \leq R < 13600$ (1075 scenarios);
– $13600 \leq R < 13800$ (161 scenarios);

Let's make up a bar chart of interval data of the simulated production process for one month – November 2019, based on 10,000 scenarios simulated using the Monte Carlo method in Fig. 4.

Fig. 4. Graph ranges of simulated scripts



Source: compiled by the authors.

Therefore, according to the results in Fig. 4 we can conclude that the value of total electricity production by the energy sector of Ukraine in November 2019 will likely reach the level of production in the range from 13,000 to 13,200 million kWt (36.32% of scenarios) and in the range from 13,200 to 13,400 million kWt (32.74% of scenarios), for the level of electricity production in the range from 12,800 to 13,000 million kWt (15.34% of scenarios) and from 13,400 to 13,600 million kWt (10.75% of scenarios) there is much lower probability of occurrence, electricity production in ranges less than 12,800 million kWt and larger than 13,800 million kWt is unlikely.

3. Conclusions

This simulation study indicates a high degree of confidence in the short-term forecasting of electricity production. After all, the range with the largest share of simulated scenarios (range from 13,000 to 13,200 million kWt, which included 36.32% of scenarios) features the real data of electricity production in Ukraine in November 2019, which amounted to 13,038.1 million kWt of real production[1].

That's why in order to ensure the response in-time to destabilizing situations, as well as to anticipate the possibility of certain emergencies at different levels of the electricity sector of Ukraine, it is necessary to develop new applied methods, models for research and description of economic, political, technological and social phenomena.

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[1] Source: The Ministry of Energy of Ukraine, *Information about the work of the power complex during November 2019*, http://mpe.kmu.gov.ua/minugol/control/uk/publish/article?art_id=245436214&cat_id=245183225 [accessed 10.01.2020].

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Badanie cyklu konsumpcji i produkcji energii elektrycznej na Ukrainie metodą Monte Carlo

Streszczenie. *W artykule przedstawiono badanie symulacyjne ukraińskiego sektora energii elektrycznej metodą Monte Carlo. Autorzy zaprojektowali model symulacyjny do prognozowania produkcji energii elektrycznej na Ukrainie. W modelu uwzględniono następujące wskaźniki: przewidywane przedziały konsumpcji dla wszystkich grup konsumentów; mediany i odchylenia standardowe przedziałów zużycia energii elektrycznej; średni procent (netto) zużycia energii elektrycznej w stosunku do całkowitej produkcji energii elektrycznej. Wynikiem symulacji jest wartość całkowitej produkcji energii elektrycznej na Ukrainie w listopadzie 2019 r. Badanie symulacyjne wskazuje na wysoki stopień zaufania do krótkoterminowych prognoz produkcji energii elektrycznej.*

Słowa kluczowe*: rynek energii elektrycznej, model symulacyjny, metoda Monte Carlo, prognozowanie produkcji energii elektrycznej, prognozy pesymistyczne i optymistyczne, cykl konsumenta i produkcji, struktura zużycia*

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