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Participance of Ukraine and Eastern European countries in global value chains.

I. A. Sheiko[1], Candidate of Economic Sciences, Associate Professor
O.V. Storozhenko[2], Candidate of Technical Sciences, Associate Professor
O. V. Kurdenko[3], senior lecturer

Abstract. *The aim of the study.* The aim of the article is to determine the role of Eastern European countries, including Ukraine, in global value chains and to form a list of potential areas for diversification of exports of the analyzed countries. *Methods.* In our research general scientific methods like system approach, analysis, synthesis, generalization, comparison were used. Also we used time series analysis, graphical method for visualization of research results. *Results of the research.* The article analyzes the activity of participation of Eastern European countries in global value chains. It is established that analyzed countries have a significant potential for export diversification, but their current share at global market does not exceed 3%. It is proposed to estimate export flows using indicators of economic complexity and diversity rate. The dynamics of economic complexity index was analyzed. It is found that the level of economic complexity in Ukraine is the lowest among analyzed countries with a tendency to decrease. The new export positions of each country were analyzed. It was pointed out that Ukraine introduced the largest number of new products, but the volume of export is the lowest among selected countries. An estimation of trade flows between analyzed countries and some global players was carried out. It was established that trade activity between Poland, Czech Republic and Slovakia was stronger than their trade with

[1] *Kharkiv National University of Radioelectronics; Candidate of Economic Sciences, Associate Professor of Economic Cybernetics and Management of Economic Security; ID ORCID: https://orcid.org/0000-0002-5770-3677; e-mail: irina.sheiko@nure.ua*
[2] *Kharkiv National University of Radioelectronics; Candidate of Economic Sciences, Associate Professor of Economic Cybernetics and Management of Economic Security; ID ORCID: https://orcid.org/0000-0003-1674-9350; e-mail: oleksandra.storozhenko@nure.ua*
[3] *Kharkiv National University of Radioelectronics; senior lecturer of Economic Cybernetics and Management of Economic Security Department; ID ORCID: https://orcid.org/0000-0002-2127-230X; e-mail: oleksandr.kurdenko@nure.ua*

Ukraine. It has also been proven that the main trading partners of Eastern Europe are located within the European Union. Perspective directions of export diversification of selected countries were singled out and opportunities of cooperation between them are defined. It is established that Ukrainian companies need the support to increase the profitability of participation in global value chains and gain additional opportunities to present their products on the world market. *Practical meaning*. The results of the study can be used by economic entities for determining the most perspective export areas, by public authorities to monitor the effects of export diversification and to assess the effectiveness of reorientation of domestic enterprises. *Prospects for further research.* The obtained results are the basis for modeling and forecasting the consequences of the state policy of export diversification of Ukraine and estimating efficiency of such policies.

Key words: international trade, globalization, diversification of export, Economic Complexity Index, Diversity rank, Product Complexity Index

Участь України та країн Східної Європи у глобальних ланцюжках створення вартості

Ірина Анатоліївна Шейко[1]**,** к.е.н., доцент
Олександра Володимирівна Стороженко[2]**,** к.т.н., доцент
Олександр Васильович Курденко[3]**,** старший викладач

Анотація. *Мета дослідження*. Метою статті є визначення ролі країн Східної Європи, включаючи Україну, у глобальних ланцюжках створення вартості та формування переліку потенційних напрямів для диверсифікації експорту аналізованих країн. *Методи.* В ході дослідження використано загальнонаукові методи та підходи, системний підхід, аналіз, синтез, узагальнення, порівняння. Також використані методи аналізу часових рядів, графічний метод для візуалізації результатів дослідження. *Результати дослідження*. У статті проведено аналіз активності участі країн Східної Європи, а саме – України, Польщі, Чехії та Словаччини, у глобальних ланцюжках створення вартості. Встановлено, що аналізовані країни Східної Європи мають значний потенціал у диверсифікації експорту, проте поточна частка кожної країни на світовому ринку у розрізі

[1] *Харківський національний університет радіоелектроніки; к.е.н., доцент, доцент кафедри економічної кібернетики та управління економічною безпекою; ID ORCID: https://orcid.org/0000-0002-5770-3677; e-mail: irina.sheiko@nure.ua*
[2] *Харківський національний університет радіоелектроніки; ; к.е.н., доцент, доцент кафедри економічної кібернетики та управління економічною безпекою; ID ORCID: https://orcid.org/0000-0003-1674-9350; e-mail: oleksandra.storozhenko@nure.ua*
[3] *Харківський національний університет радіоелектроніки; старший викладач кафедри економічної кібернетики та управління економічною безпекою; ID ORCID: https://orcid.org/0000-0002-2127-230X; e-mail: oleksandr.kurdenko@nure.ua*

окремих секторів не перевищує 3%. Запропоновано оцінювати експортні потоки за допомогою показників економічної складності та ступеня диверсифікації. Проаналізована динаміка показника економічної складності за період 2003-2018 рр. Встановлено, що рівень економічної складності в Україні найнижчий серед аналізованих країн з тенденцією до зниження. Проаналізовані нові експортні позиції кожної країни впродовж 2003-2018 років. Встановлено, що Україна запровадила найбільшу кількість нових товарів, проте обсяги постачання настільки малі, що нові товари виявилися не здатні суттєво підвищити рівень доходу. Україна має значно вищу за складністю структуру експорту, ніж це можна передбачити за рівнем її доходу. Проведено оцінку експортно-імпортних потоків між аналізованими країнами та такими глобальними гравцями, як Німеччина, США та Китай. Встановлено, що торгівельні зв'язки між Польщею, Чехією та Словаччиною сильніше ніж торгівля з Україною. Також доведено, що основні торгівельні партнери країн Східної Європи розташовані в межах Європейського Союзу. Виокремлені перспективні напрями диверсифікації експорту України та країн Східної Європи та визначені можливості кооперації між країнами. Встановлено, що українські компанії потребують підтримки державних органів та законодавчої системи для підвищення прибутковості участі у глобальних ланцюжках створення вартості та отримання додаткових можливостей представляти свою продукцію на світовому ринку. *Практичне значення.* Результати дослідження можуть бути використані економічними суб'єктами експорто-імпортних операцій в плані визначення основних перспективних напрямів диверсифікації експорту, органами державної влади для моніторингу наслідків диверсифікації структури експортної продукції, а також для оцінки ефективності переорієнтації вітчизняних підприємств на випуск більш технологічно складних видів продукції. *Перспективи подальших досліджень.* Отримані результати є основою для моделювання і прогнозування наслідків державної політики диверсифікації експорту України, а також моделювання економічної ефективності таких заходів. Також на основі результатів аналізу можуть бути проведені дослідження щодо впливу участі України у глобальних ланцюжках вартості на макроекономічні показники розвитку країни

Ключові слова: міжнародна торгівля, глобалізація, диверсифікація експорту, індекс економічної складності, індекс різноманітності, індекс складності продукту.

Introduction

From the beginning of 21st century the radical transformation of international trade pattern has been performed: from traditional international trade, when country export finished goods that are consumed of buyers of another country to the new pattern of global value chains (GVCs). Nowadays, 70% of international trade involves a variety of transactions

where services, raw materials, parts and components are exchanged in GVCs across countries until they reached the final consumer.

Global value chains (GVC) have grown substantially in recent decades. Global value chains became a dominant feature of world trade over the past several decades in part due to technological innovations allowing firms to split production processes across countries (the ICT revolution) (OECD, 2020b).

Organisation for Economic Co-operation and Development (*OECD, 2013*) reported, that 80% of the world's value added is generated in production and trade chains, controlled by corporations. The speed of economic development, the volume of foreign trade and the place in the world division of labor depend on the volume of orders placed by transnational corporationss in a given country (*World Bank, 2017*). Therefore, it is important for countries to participate in global value chains.

For a wide range of goods and services, the production stages are sliced up and distributed across many countries. Components of products move through production centers with value being added at each stage. Most of these chains are spearheaded by multinational corporations, spurred by a number of factors as:

– liberalization of trade and capital flows in emerging market and developing countries;

– decline in transportation and production costs amid large wage differences between advanced, emerging market, and developing economies;

– advances in information and communication technologies that made the complex coordination of production processes at distance possible.

Such organizing of international trade create new opportunities for small and medium-sized enterprises (SME) to expand to global markets as suppliers of intermediate goods and services, without having to build the entire value chain of a product. At the same time, firms face new challenges as regards the need for strong coordination and efficient links between production stages and across countries (*OECD, 2020b*).

COVID-19 pandemic make discussion of such risks very actual. The risks associated with GVCs were initially revealed in the very first phase of the pandemic in early 2020, when the public health situation in the People's Republic of China (hereafter "China) resulted in lockdowns. Most global manufacturers have some operations in China and many businesses reported disruptions to production and trade from this important GVC partner. Shortages of supply of personal protective equipment (PPE) as well as key respiratory medical devices, such as ventilators, have raised greater concerns. The global shortage of medical devices stemmed from the unprecedented demand shock induced by the spread of the pandemic around the world (*OECD, 2020a*).

Also COVID-19 pandemic raised the questions about concentration on domestic supply and demand in a case of border restrictions. Countries start to analyze the flows of import and opportunity to use domestic item instead imported ones.

That is why the problem of analysis of participation in GVC for countries and regions is very actual

2. Literature review

As a model, the GVC describes the sequence of production process from first supplier to final. The parts of the chain do

not compete with each other, but rather cooperate to achieve the goal.

GVCs generate significant economic gains to both participating firms and countries that host GVC activities (OECD,2013). Specialisation and economies of scale bring productivity gains as well as lower production prices (*Andrews, Gal and Witheridge, 2018, p.6)*. GVCs have also created new opportunities for smaller firms and participants from emerging-market economies and developing countries as they no longer have to master all the stages of complex production processes in order to participate in the global economy.

International organizations such as the Organization for Economic Co-operation and Development (OECD) and the World Trade Organization (WTO) analyze international trade through the prism of the global value chains that underlie international flows of goods and services.

A particular implication of global value chains is that traditional export statistics obscure how value added is traded in the global economy - conventional data overstate the domestic value added content of exports (since conventional gross trade statistics tally the gross value of goods at each stage of the border crossing instead of the net value added between border crossings).

Computation of value added content of trade requires a global input output table where individual country tables are combined and linked via international trade matrices.

Several global input output data sets have been developed under various data initiatives and are accessible to researchers: World Input Output Data Base (WIOD); WTO OECD TiVA Database (Trade in Value Added); UNCTAD's EORA Database; IDE JETRO Asian Input Output Tables.

Most common indicators analyzed include:

– VAX ratio : a measure of the share of domestic value added in gross exports. R. Johnson and G.Noguera (*Johnson and Noguera, 2012, p.229*) combined input–output and bilateral trade data to compute the value added content of bilateral trade and proposed the ratio of value added to gross exports (VAX ratio), that is a measure of the intensity of production sharing.

– Backward linkage (BL): a measure of the extent to which domestic firms use intermediate goods and services for exporting activity

– Forward linkage (FL): a measure of the degree to which a given country's domestic value added in gross exports are used by partner countries as inputs in their own exports

– GVC participation rate : sum of backward and forward linkages

– GVC position index : FL/BL – such index defines, is country is closer to supplier's end of GVC (value less than 1), or to demand stage (value greater than 1)

For the world as a whole, the VAX ratio has declined by about 10% over four decades, but the decline has not been uniform through time (*Banerjee and Zeman, 2020*).

C. Criscuolo and J. Timmis (*Criscuolo and Timmis, 2018*) studied the roles of central hubs of GVC - such elements, that are allocated at the middle of chain. Authors found that becoming more central as a customer is associated with faster productivity growth of smaller firms. Also they found, that service sectors in emerging economies are increasingly central to foreign manufacturing customers. Manufacturing

sectors in emerging economies are also increasingly connected to foreign services suppliers.

P. Antras (*Antras, 2020*) proposed key conceptual aspects associated with the rise GVCs. He proves the importance of GVCs for global trade and summarized effects of participation in GVC for firms and countries. Author also pointed out, that digital technologies encourage GVC participation by reducing many of the barriers that company face when attempting to join GVCs.

WTO Report (*WTO, 2019*) analyzed the effect of global value chains on global production. In paper it is pointed out that GVC activities picked up in 2017 after a period of slow down since 2012; intra-North American and intra-European GVC activities declined relative to inter-regional transactions due to higher penetration via Factory Asia but value chains still remain largely regional.

Degain, C., Maurer, A. and MacFeely, S. (*Degain, Maurer and MacFeely, 2016*) proposed such measures of trade activity, that can be calculated on WTO OECD TiVA Database: the inter-linkages with other sectors and the length of global linkages. At international trade such index as GVC-oriented foreign direct investments can be used.

Banerjee and Zeman (Banerjee and Zeman, 2020) analyzed provided multivariable analysis of GVC indicators and examined the impact of the real exchange rate (REER) on GVC participation indicators. Author made conclusion, that higher export share may not necessarily imply higher competitiveness if exports contain a large share of imported intermediate goods.

In World Bank Global Value chains 2017 Report (*World Bank, 2017, p.1-14*) some conclusions about importance and perspectives of GVC for economic development were made. Authors pointed out such factors, that can impact on country's participation in GVC: geographically location, unit-labor costs and trade costs The world seems to have three interconnected production hubs for the extensive trade in parts and components: one centered on the United States, one on Asia (China, Japan, Republic of Korea), and one on Europe (especially Germany). The countries more deeply involved in GVCs all stand out as having low unit labor costs, but not necessarily low wages.

Kowalski, P., et al. (*Kowalski et al.,2015*) found out, that there are important benefits from wider participation in GVC like increased productivity, diversification of exports. Authors summarized such determinants of GVC participation: geography, size of the market and level of development, trade and investment policy reforms as well as improvements of logistics and customs, intellectual property protection, infrastructure.

The Growth Lab at Harvard University created an Atlas of economic complexity (*Atlas of Economic Complexity*). The Atlas places industrial capabilities and knowhow (level of existent knowledge) of a country at the heart of its growth prospects, where the diversity and complexity of existing capabilities heavily influence how growth happens. Such online platform consist information about what does a country import and export, what was the dynamic of trading, what are the drivers of export growth, what are the main exporters and importers on global market for defined product, what are the growth projections for a country and most suitable policy for

export diversification. Such information becomes very useful for our study.

OECD report (*OECD,2017*) studied relation between GVCs and global innovation networks (GINs). the paper has provided evidence on the growing importance of international linkages in the innovation landscape of countries; companies are increasingly opening their innovation process and collaborating with other partners across borders. GVCs and GINs both show a strong regional character with trade and co-invention relationships still strongly concentrated within supra-national regionals (North America, Europe and Asia). In general, GVCs and GINs show a strong overlap in geographic concentration with hubs in GVCs often also being hubs in GINs.

World Bank Report (*World Bank, 2020*) set out a comprehensive domestic agenda for governments to activate participation in GVC: investments in connectivity, improvements in business climate, and unilateral reductions in trade and investment barriers. Also coordinated trade liberalization between countries plays an important role in economic development.

A. I. Khvostikov (*Khvostikov ,2020*) proposed procedure for assessing the quality of international trade and economic relations using the method of fuzzy logic on case of agriculture sector of Ukraine. Author made a conclusion, that the biggest problem for the further expansion of Ukrainian companies on global agricultural market is the lack of mechanizms to carry out international banking settlements.

Authors (*Khaustova et al, 2020*) proposed positioning of industries in the plane of coordinates "share in the exports value – share in the national value added in exports". It has been determined that the share of national value added in the exports of Ukrainian mining sector is higher than average global level, while value added in the exports of manufacturing sphere is lower, which confirms the nearly total lack of knowledge-intensive and innovative stages of manufacturing thus raising the share of low-grade products in exports.

OECD report (*OECD, 2020a*) pointed out, that COVID-19 has highlighted both the strengths and weaknesses of GVCs, including for the supply of essential products. Past experience suggests that international production networks can be disrupted and play a role in the propagation of economic shocks across countries and industries. But they also help firms and countries to recover faster.

Analysis of theoretical approaches to GVC allows us to define the main sources of data, the main indexes, that it is worth to analyze to evaluate the role of separate country in global value chains.

3. Methods. The following methods were used in the study: analysis and synthesis, induction and deduction, system-structural methods, comparative analysis, graphical method, time-series analysis, logical abstraction.

4. Research objectives.

The main purpose of our investigation is to analyze the role of Eastern Europe countries, including Ukraine, in global value chains and to summarize the most perspective direction of export diversification for selected countries

5. Results and Discussions

The value chain includes all business processes starting from Research and Development of a new product (R&D) to the delivery of the final product. Value added can be based on system integration,

outsoursing, consulting, training, implementation, etc. Value chain operates not only within one company, but also joins different companies from another countries and transform into global value chain (GVC). The key players in global chains are muntinational corporations (MNC).

According to the OECD (*OECD, 2013*) for the period from 1995 to 2009, the level of entry of countries into global value chains increased by an average of 5-10%, and in some (India, China, South Korea) - by 10-20%. This trend continues today. Approximately 40% of OECD member countries' exports are foreign value added (*OECD, 2013*).

According to the United Nations Conference on Trade and Development (*UNCTAD, 2013, p. 123*), it was reported that 80% of the world's value added is generated in production and trade chains controlled by corporations. The speed of economic development, the volume of foreign trade and the place in the world division of labor depend on the volume of orders placed by TNCs in a given country . Therefore, it is important for countries to participate in global value chains

In our investigation we try to estimate the role of Eastern Europe region in global value chains and to make conclusions about perspectives of further expansion of selected countries (Ukraine, Poland, Czech Republic and Slovak Republic) on global markets. For this purpose we need to analyze the export structure of Eastern European countries, how does it changed in time, how complex is the main products of the country and what are the projections for export diversification for each country. Also it is useful to analyze trade connection between countries.

To provide such analysis we use a data of global agencies, such as World Bank, Organization for Economic Development and Cooperation (OECD), World Economic Forum, The Growth Lab at Harvard University.

To estimate the role of Eastern European countries in global value chains we choose four countries: Ukraine, Poland, Czech Republic and Slovak Republic. The choice of them was made due to close economic and trade relations, geographical location, growth of economic development in Poland, Czechia and Slovakia, that can represent useful experience for forming national industrial and trading policies for Ukrainian government agencies.

Our investigation we start from analysis of export structure and dynamics in selected countries. The Growth Lab at Harvard University (Hausmann, Rodrik and Velasco, 2005; Hausmann and Klinger, 2007) in online service "Atlas of Economic Complexity" (Atlas of Economic Complexity) represent calculation of Economic Complexity Index (ECI) for each country, that indicate, how diversified and complex their export basket is. The economic complexity of a country is calculated based on the diversity of exports a country produces and their ubiquity, or the number of the countries able to produce them (and those countries' complexity). Countries that are able to sustain a diverse range of productive know-how, including sophisticated, unique know-how, are found to be able to produce a wide diversity of goods, including complex products that few other countries can make. (Hausmann, Rodrik and Velasco, 2005).

Due to available data (Atlas of Economic Complexity), among selected countries the highest ECI has Czech

Republic - 7th position in world ECI ranking. The leaders of ranking due to Growth Lab calculations are: Japan (1st rank), Switzerland (2nd rank), South Korea (3d rank). Ukraine ranks as the 44th most complex country in the Economic Complexity Index (ECI) ranking. Ukraine's stagnant complexity has occurred alongside the falling diversification of its exports. Moving forward, Ukraine is positioned to take advantage of many opportunities to diversify its production using its existing knowhow - existing level of knowledge.

The dynamics of ECI ranking for selected countries is shown at figure 1. Due to represented data, Czechia and Slovakia increased ECI level, Poland remain at stable position, but Ukraine has loose about 10 positions during analyzed period (more dark color associated with greater complexity level).

Another index, that is worth to mention is diversity rank, that show how many different types of products a country is able to make. The production of a good requires a specific set of know-how; therefore, a country's total diversity is another way of expressing the amount of collective know-how held within that country (*Atlas of Economic Complexity*).

Due to Growth Lab calculations (*Atlas of Economic Complexity*), in 2018 Ukraine occupied 43th diversity rank among 133 countries. The highest positions among selected countries belongs to Poland (6th rank), Czechia has 14th diversity rank, and 34th position for Slovak Republic is much closer to Ukraine, than to leaders of ranking.

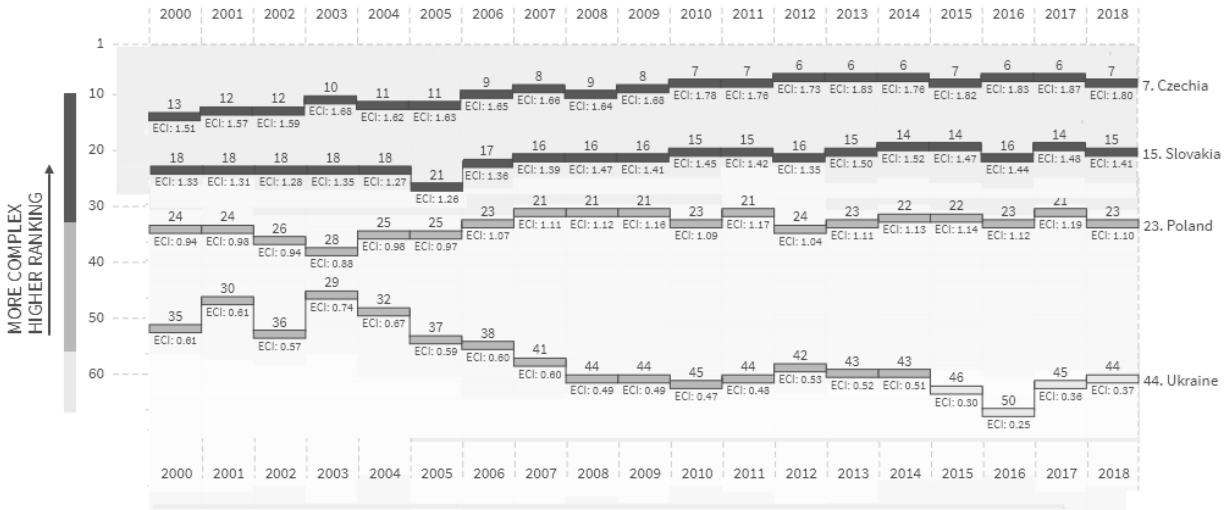

Fig.1. **Dynamic of ECI for selected countries**
Source: selected by authors from (*Atlas of Economic Complexity*)

To analyze participation of selected countries in GVCs it would be useful to analyze the globalization and competitiveness rankings.

Currently, the most common and cited is the KOF Globalization index, developed by the Swiss Institute of Economics and covering the period 1970 to 2018, with a calculation of 42 parameters for 209 countries (2018 version). The KOF Globalization Index identifies the economic, social and political aspects of globalization. Economic globalization reflects the flows of goods, services, capital and information that accompany such exchanges. In economic globalization, there are separate trade and financial

components. Among selected countries the highest position in KOF Globalization Index (Overall and Economic Globalization) belongs to Czech Republic, Ukraine has the lowest ranking among analyzed countries. The same comparisons are right for Global Competitiveness Ranking 2019, but positions of selected countries is lower than positions in globalization indexes, because competitiveness is much complex term, that include not only global activity, as globalization (.

In table 1 all mentioned indexes for selected countries are represented.

Qualitative characteristic of development in GVC participations can be: dynamics of production and export, trade balance of the country, quantity of new products, that country start to export. Such parameters it is worth to analyze for selected countries.

Table 1. **Summary of several global rankings for selected countries**

Index / Counry	Ukraine	Slovak Rep.	Czech Rep.	Poland
Economic Complexity Index (ECI) ranking 2018	44	15	7	23
Diversity Rank	43	34	14	6
Globalization Rank (Overall Index) 2019	44 (74.95)	24 (82.66)	13 (84.88)	33 (79.7)
Economic Globalization Rank (Overall Index) 2019	66 (66.01)	18 (82.52)	15 (82.69)	40 (72.84)
Global Competitiveness Ranking 2019 (Score)	85 (57.0)	42 (66.8)	32 (70.9)	37 (68.9)

Source: systematized by the author on data of (Atlas of Economic Complexity; Gygli et al, 2013; World Economic Forum, 2019).

Ukraine during 2015-2018 introduced 40 new products, that had 5% of total export during this period. Ukraine increased export of such complex products as: iron and steel (export growth is 7.48%); electrical machinery and equipment (growth on 15.4%), plastics (18.84%), organic chemicals (43.48%), trains (8.17%). Also such export services as transport (on 3.63%), travel and tourism (on 10.12%) grown up. Ukraine has positive export dynamic on such product positions as ores and slag (on 8.35%), oil seeds (on 7.23%), cereals (on 3.23%), animal or vegetable fats and oils (on 10.71%), mineral fuels and oils (on 8.12%), meat (on18.6%). But during 2015-2018 export of ICT products reduced on 24.17%, inorganic chemicals has -9.57% export growth, industrial machinery has -3.13% export growth, aircrafts reduced on 30.3% (Atlas of Economic Complexity).

Another selected Eastern European countries during 2015-2018 increased complex machinery and electronic products equipment.

Poland during 2015-2018 increased export of vehicles on 11.6%, industrial machinery on 11.13%, apparatuses (medical, optical, etc) on 20.8%, organic chemicals on 11.8%, electrical machinery and equipment on 5.4%. Also in Poland such export services as transport (on 16.8%), travel&tourism (on 10.3%) and preparation of vegetables, fruits or nuts (on11.5%) were increased. But Poland reduced export of such items as ICT on 20.5%, ships on 14.6%, cereals on 10.6% (Atlas of Economic Complexity).

Czech Republic demonstrate a successful case, with the largest contribution to export growth coming from high complexity products like

industrial machinery (has grown up to 11.8%), vehicles (growth on 9.3%) and electrical machinery and equipment (growth on 11.5%). Slovakia also during 2015-2018 increased export of identical categories of complex products as Czechia: vehicles (growth on 11%), industrial machinery (growth on 7.4%) and electrical machinery and equipment (growth on 5%). But ICT sector reduced export on 20% in Czechia and on 33% in Slovakia.

For comparison, Germany during 2003-2018 introduced only 5 new export products, that increased income per capita on 6$ with total value 539 mln. USD.

Analysis of export growth positions in each country allows us to make some conclusions:

– each country reduced during 2015-2018 ICT export;

– each country increased export of transport service, that gives the region hope to play an important role in GVS as logistic hub. But such expectation must be based on investment on infrastructure: roads, bridges, port infrastructure, including custom clearance.

– Ukraine increased export of less complex products then other selected countries, and this define less ECI value;

– Poland, Czechia and Poland concentrated on increasing export of machinery and electronic components.

At table 2 data about quantity and income per capita for new export products of selected countries are represented.

Table 2. **Quantity and income per capita for new export products, introduced in 2003-2018**

Country	Quantity of new introduced products,	Income per capita, USD	Total value of export of new products, mln USD	Share of New products into Total Export Value in 2018,%
Ukraine	40	71	3170	5
Poland	33	257	9750	3
Czech Republic	15	343	3650	2
Slovak Republic	25	1006	5780	6

Source: summarized by authors on data (*Atlas of Economic Complexity*)

Due to represented data, Ukraine introduced greater quantity of new products in export basket, than another three countries, but those new products contributed only 71$ income per capita, that is much less than another analyzed countries. So, Ukraine has diversified into great number of new products but at too small volume to increase income per capita. Ukraine is more complex, than it is expected from its income level.

For comparison, 97% of new export products in USA, introduced in 2003-2018, belongs to refined petroleum oils, the proportion of new products in USA export value of 2018 consists 4%. Half of China's new products belongs to electronic integrated circuits, the share of new products in China export value is 7%.

Growth of export should increase country's share on world market. At figure 2 share of world market dynamics in selected countries by sectors is shown.

For Ukraine the greatest share of global market belongs to metal export, but

from 2008 this share reduced twice. At 2018 market share of agriculture export reached maximum among other export sectors of the country.

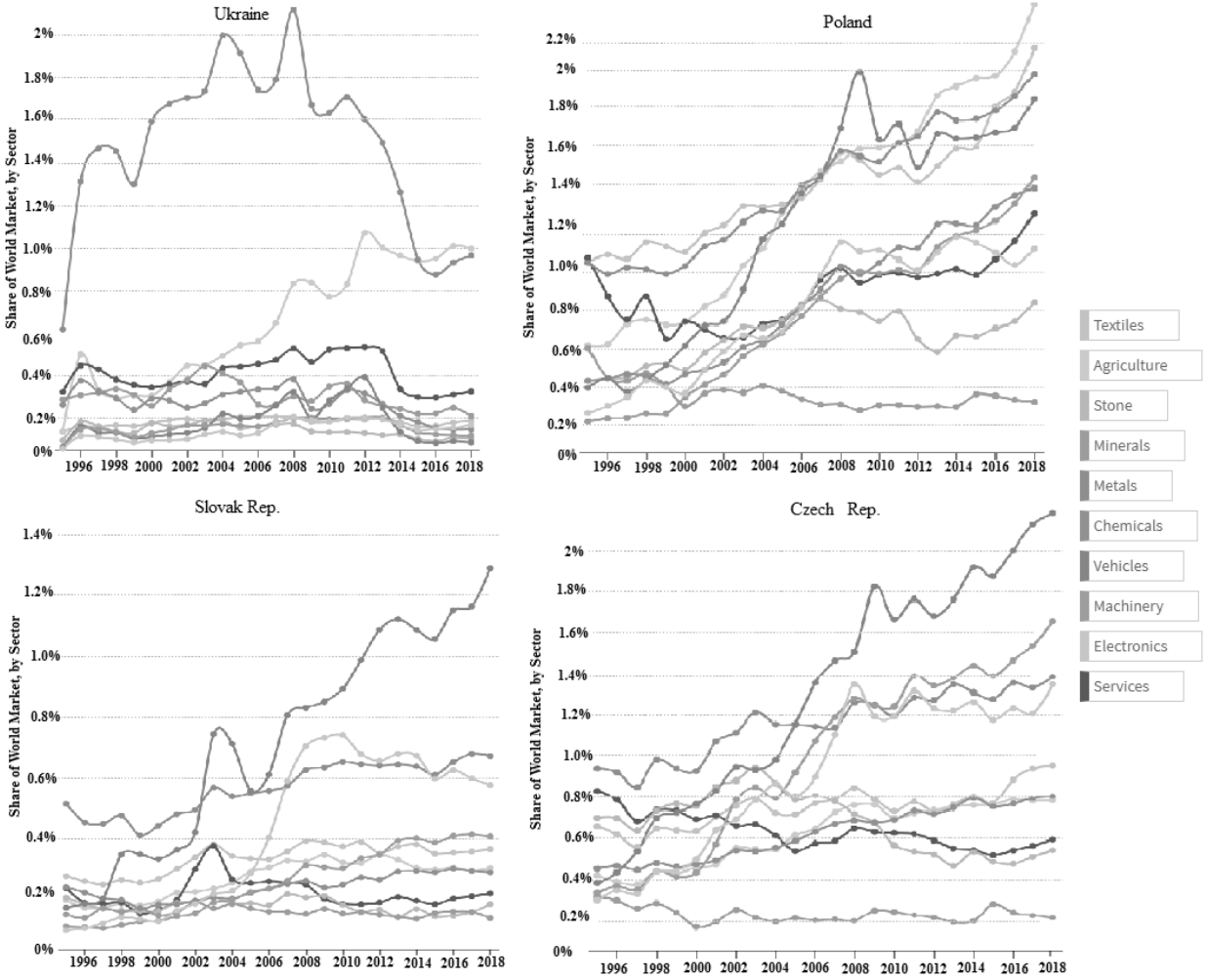

Fig. 2. **Share of World Market Dynamics in selected countries by sectors**
Source: summarized by author on data of (Atlas of Economic Complexity)

Poland's market share at agriculture sector, textiles and machinery increased significantly during past decade. For Slovakia and Czechia the main drivers of export growth during 2013-2018 were machinery and vehicles. These countries not simply concentrated efforts in a growing global sector, rather they expanded their global market share.

As we see, the market share at global market of all selected countries is not exceed 3%. But if in Poland, Czech Republic and Slovak Republic the positive tendency for most of sectors exists, for Ukraine the dynamic of global market share is not changed for most of sectors: reduced for metals from 2008 till 2018, increased for agriculture and have small fluctuation for the rest of sectors.

At table 3 the export flows among selected countries in 2018 are represented. Poland, Czechia and Slovakia export a lot to each other and to Germany, USA and China. Ukraine also export a lot to Russian Federation.

The European Union is Ukraine's main trading partner. According to the results of 2020 (*Ministry of Economy of*

Ukraine, 2021), the share of trade in goods and services with the EU amounted to 40.7% of total trade in Ukraine (according to the results of January-March 2021 – 40.0%).

Table 3. **Export flows among selected countries in 2018**

Country-exporter	Import to the country (bln USD / share of total export of the country-exporter,%)						
	Ukraine	Poland	Czechia	Slovakia	Germany	USA	China
Ukraine		3.25B/ 6.76%	0.882B/ 1.84%	0.884B/ 1.8%	2.43B/ 5.08%	1.13B/ 2.36%	2.18B/ 4.55%
Poland	5.24B / 2.03%		16.6B/ 6.44%	6.73B/ 2.6%	72.3B/ 27.97%	6.86B/ 2.66%	2.54B/ 0.98%
Czechia	1.49B / 0.76%	12.1B / 6.12%		15.2B / 7.73%	62.5B / 31.74	4.14B / 2.1%	2.78B / 1.41%
Slovakia	0.624B / 0.7%	8.15B / 6.94%	10.8B / 12.02%		17.5B / 19.8%	3.36B / 3.8%	3.57B / 4.03%
Germany	5.48B / 0.35%	74.8B / 4.78%	51.8B / 3.32%	16.4B / 1.05%		134B / 8.6%	110B / 7.07%
USA	2.48B / 0.15%	5.35B / 0.32%	3.01B / 0.18%	0.29B / 0.02%	58B / 3.5%		120B / 7.27%
China	6.97B / 0.28%	21.2B / 0.86%	12.1B / 0.49%	2.59B / 0.1%	87.3B / 3.53%	455B / 18.4%	

Source: author's development based on (Atlas of Economic Complexity)

Due to represented data, the main trade partner in export operations for Poland, Czechia and Slovakia is Germany. Germany is has positive trading balance with most of analyzed countries, except Czechia and Slovakia. Ukraine at 2018 had positive trade balance only with Slovakia, with other partners import in Ukraine was greater than Ukraine's export.

Data of export flows among countries prove, that countries of Eastern Europe play a significant role in global value chains and are important partners for each other. For Ukraine, Poland is second biggest export partner, for Poland second biggest export partner (after Germany) is Czechia. For Czechia second position as export destination is occupied by Slovakia, third - Poland. For Slovakia top export partners are Germany, Czechia and Poland. We can make a conclusion, that trade relations between Poland, Czechia and Slovakia are stronger than trade activity of them with Ukraine. But Ukraine have all possibilities to activate trading with Eastern European partners. But to do this, Ukraine have to diversify its export and concentrate on more complex products, as machinery, electronics, IT. Rational export strategy can support this purpose.

If the country want to activate participation in global value chains, it has to change and diversify structure of its export. To diversify export, government agencies create strategies and different programs, that indicate priorities of the country in production and international trade. Such strategies also created in all selected countries. Each strategy create recommended directions of further development. For example, Ukrainian Export strategy has an overall vision of moving Ukraine into "Knowledge- and innovation-based exports for sustainable development and success in global markets" (*Ministry of Economy of Ukraine, 2020, p.11*) and three main goals:

– to create an enabling environment that stimulates trade and innovation for diversified exports;

– to develop business and trade support services that improve the competitiveness of enterprises, in particular SMEs;

– to strengthen the skills and competencies that enterprises, in particular SMEs, require to engage in international trade.

What country can do to diversify its export and expand to global markets? Scientists from Growth Lab Harvard University propose four variants of recommended policies. They are:

– Strategic Bet Policy - countries, that have low levels of complexity and low opportunities to diversify production, need to perform so called "long jump" into strategic areas with diversification potential;

– Parsimonious Industrial Policy approach is recommended for countries with current low level of complexity, but great number of opportunities for diversification. Such countries, with support of rational industrial policy, need to move to related products with high complexity;

– Light Touch Approach is suitable for countries with high level of complexity and high diversity. Due to this approach country need to choose among lot of opportunities and diversify production and export to more complex production;

– Technological frontier approach is suitable for countries with high complexity, that export the full range of existent products, such way they don't have much opportunities to diversify. This means. that main efforts country should direct on creation of new products - R&D, innovation. This approach is recommended to high developed countries.

On the basis of these four recommended approaches the visualization of position of each country can be made due to coordinate axes "complexity-diversity". At such graph four quadrants appears, that associated with four recommended strategic approaches, mentioned above. Each country due to its position (quadrant) can choose suitable approach to diversify its economy.

Figure 3 shows the position of selected countries among four quadrants of the recommended strategic approaches On the basis of diversity rate and complexity rate three countries: Ukraine, Poland and Slovakia appears in quadrant "Light Touch Approach". The leader of this quadrant (top-right corner) is India. Countries in such quadrant should diversify production and export to more complex production among several existent opportunities. All countries in this quadrant are well-connected to many new opportunities, and the main question is the accurate choice of direction for diversification.

As about Czech Republic, this country is allocated, due to Atlas of Economic Complexity, in quadrant of "Technological Frontier Approach". So Czechia, have produced virtually all existing products, gains come from developing new products.

Also for purposes of our study it is important to define most important groups of products, that each analyzed country can introduce to diversify its export and to increase complexity of products.

Scientists from Growth Lab Harvard University propose several most perspectives direction for each country to diversify its export - potential growth

opportunities. It is worth to say, that such recommendations are not prepared for countries from technological frontier (see fig. 3).

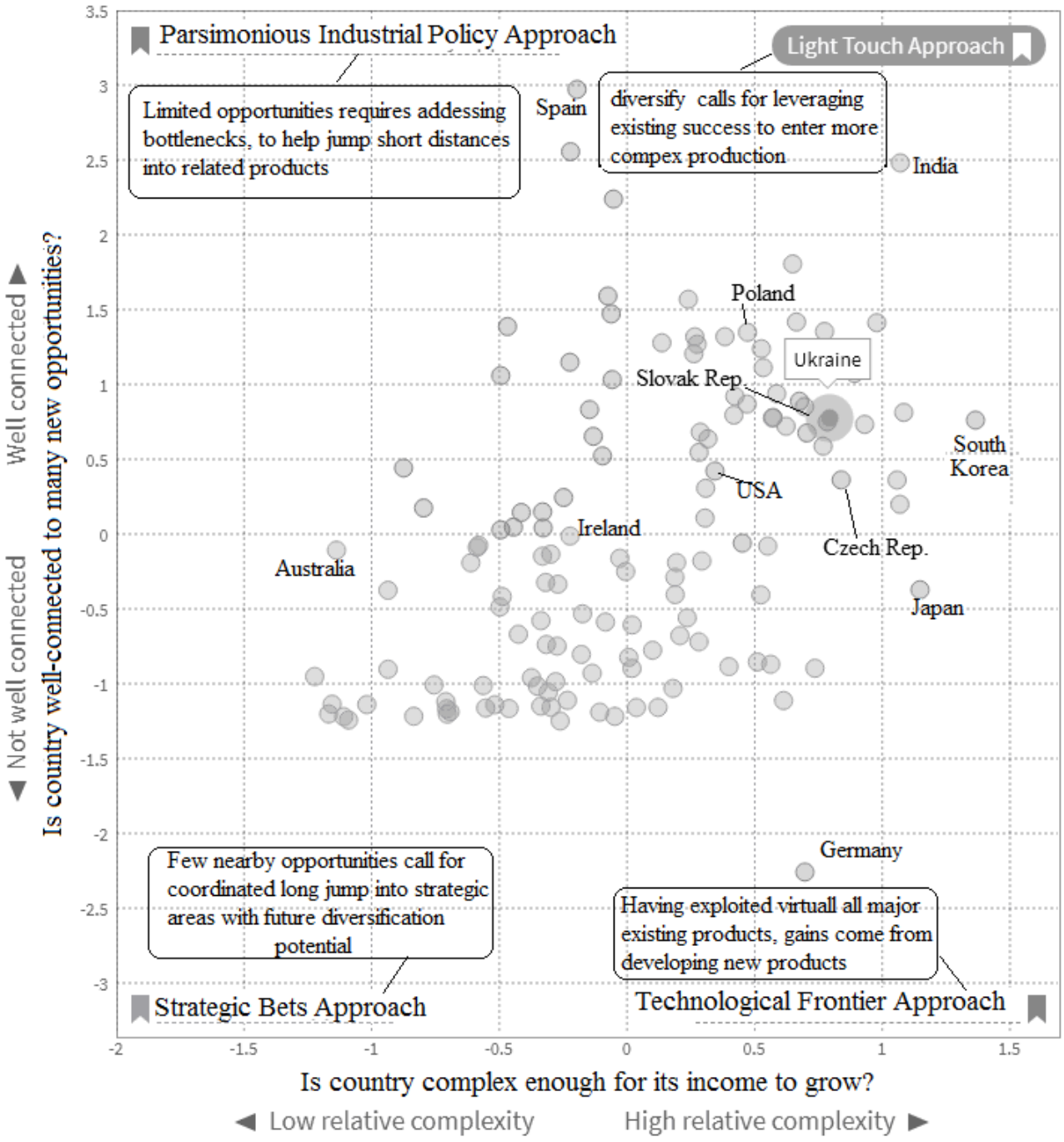

Fig. 3. **Four quadrants of recommended strategic policy for export diversification**

Source: author's development based on (Atlas of Economic Complexity)

From analyzed countries there is only one from technological frontier - Czech Republic, for which potential growth opportunities are not defined due to full export basket of the country. For further development Czechia have to create new types of products. For three other analyzed countries the most perspective groups of products are defined. On the base of data (*Atlas of Economic Complexity,2020*) we formed for each country perspective products with closest

distance to existent export products, and available products with highest product complexity index (PCI).

PCI index is is calculated based on how many other countries can produce the product and the economic complexity of those countries. The most complex products, that only highly complex countries can produce, include complex machinery, electronics and chemicals, as compared to the least complex products, that nearly all countries can produce, including raw materials and agriculture. Specialized machinery is said to be complex as it requires a range of know-how in manufacturing, including the coordination of a range of highly skilled individuals' know-how (*Atlas of Economic Complexity,2020*).

Distance is a measure (from 0 to 1) of a country's ability to enter a specific product and indicate how closely related a product is to its current exports. A 'nearby' product of a shorter distance requires related capabilities to those that are existing, with greater likelihood of success. On Growth Lab technically distance is calculated as probability of co-export, that if a country exports product A, what is the probability they also export product B. The product proximities are fixed globally and measured using 128 countries' export data over 50 years. The *distance* of a product is then the sum of the proximities connecting that product to all the products that the location is not currently exporting (*Atlas of Economic Complexity,2020*).

As we see in table 4, potential growth opportunities for Ukraine is not so complex, as for other selected countries. Ukraine can not introduce such types of products, that other Eastern European countries can. Ukraine have opportunity to produce such machinery products as trailers and semi-trailers, harvesting or agricultural machinery, but such products has low PCI level, because a lot of countries can produce them.

The nearest opportunity for Ukraine (product with minimum distance) – aluminum structures (bridges, towers). Ukraine has all raw materials to produce them (country currently export these raw materials), so more profitable is to produce final goods from raw materials and export them, because complexity and value added of final products is much higher than for raw materials.

But Ukraine can cooperate with Poland, Slovakia and Czechia in production of complex products. For example, Ukraine can export engines and motors for machinery final products, produced in Eastern Europe. Parts of motors have global market size on 400 bln. USD, which expected growth rate during 2018-2022 on 15% (*Atlas of Economic Complexity,2020*).

Poland and Slovakia has opportunities to expand to markets with greater complexity, such as machines, machine centers, inorganic compounds. cermets. The distance from existent products to proposed is minimal in Poland and greater in Ukraine and Slovakia - Poland need to make the short "jump" to a new products, while two other countries need to receive additional knowledge, technology, skills, investments to make existent export basket more complex.

So, Eastern European countries can find opportunities for cooperation, that allows countries to activate participation in global value chains. Perspective direction of such cooperation could be machinery, IT sector, chemical industry.

Table 4. **Potential Growth Opportunities for selected countries**

	Most "nearby" products			Most complex products		
	product	distance	PCI	product	distance	PCI
Ukraine	Aluminum structures (bridges, towers, etc)	0.78	0.422	Transmission shafts	0.819	1.59
	Refrigerators, freezers	0.784	0.63	Equipment for temperature change of materials	0.805	1.55
	Baths, sinks, etc	0.786	0.62	Machine tools for drilling by removing metal	0.811	1.39
	Trailers and semi-trailers	0.786	0.686	Other engines and motors	0.814	1.27
	Harvesting or agricultural machinery	0.786	0.88	Parts for motor	0.81	1.2
Poland	Machinery parts, not containing electrical features	0.561	1.13	Cermets	0.623	2.16
	Vacuum cleaners	0.575	1.28	Calendaring or other rolling machines, other than metal or glass	0.618	1.97
	Appliances for thermostatically controlled valves	0.577	1.75	Machines	0.63	1.88
	Parts and accessories for metal working machines	0.577	1.41	Electric soldering machines	0.593	1.88
	Pumps for liquids	0.58	1.31	Machines with grinding stones for finishing metal	0.618	1.87
Slovakia	Machinery for making paper	0.734	1.74	Machining centers for working metal	0.816	2.38
	Knives and blades for machines	0.742	1.42	Cermets	0.762	2.16
	Appliances for thermostatically controlled valves	0.747	1.75	Halides for nonmetals	0.821	2.08
	Grindstones	0.752	1.56	Inorganic compounds, liquid or compressed air	0.823	2.06
	Transparent paper	0.757	1.87	Articles for utensils, for cermet	0.785	2.02

Source: author's development based on (Atlas of Economic Complexity)

6. Conclusion

On the basis of our study we can make conclusions about greater participation of analyzed Eastern Ukraine countries in global value chains than Ukraine. Our border countries in Eastern Europe have already passed the stage of economy transformation and Ukraine have all possibilities to repeat their successful experience

Some of the risks associated with participation in global value chains include being locked into low value-added stages of GVCs with limited spillovers to the domestic economy - this situation is common for Ukraine . The importance of looking at a chain (rather than at individual stages of production) suggests that approaches to trade capacity-building should start from a broad view of how a country would like to change its trade pattern and then assess all the obstacles to this.

As a success stories of South Korea, Taiwan, Malaysia with their progress in GVC participation proves, local companies need support from state agencies and legislative system to increase the profitability of GVC participation and receive additional possibilities to represent their products on global market. Such support should be balanced, based on state priorities, that are fixed in laws, strategies. Also to diversify

export, Ukraine should propose clear and effective investment mechanism to motivate foreign investors for opening production lines in country

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