Studia commercialia Bratislavensia

Vedecký časopis Obchodnej fakulty Ekonomickej univerzity v Bratislave

Scientific Journal of Faculty of Commerce, University of Economics in Bratislava

Číslo/No.: 57 (3/2023), Ročník/Volume: 16

Studia commercialia Bratislavensia

Vedecký časopis Obchodnej fakulty Ekonomickej univerzity v Bratislave

Scientific Journal of Faculty of Commerce, University of Economics in Bratislava

Adresa redakcie *(Editorial office)*

Obchodná fakulta
Dolnozemská cesta 1
852 35 Bratislava
Tel.: 00421 2 672 91 130
Fax: 00421 2 672 91 149
E-mail: redakcia.scb@euba.sk

Vydáva *(Published by)*

Obchodná fakulta Ekonomickej univerzity v Bratislave, Dolnozemská cesta 1, 852 35 Bratislava, IČO 00399957

Číslo 56 (3/2023) bolo vydané v mesiaci Septembér 2023.
No. 56 (3/2023) was edited and published in September 2023.

ISSN (online) 1339-3081

Obsah Contents

Marketing innovations of enterprises in the EU[1]

Henrieta Harcsová, Adrián Čakanišin[2]

Abstract

Marketing innovation is a key tool for businesses to expand their marketing skills and move forward. There are many marketing innovations available on the market but the most crucial are changes in aesthetic design or packaging, new methods of product placement, new media or techniques for product promotion, and new methods of valuing goods or services. The aim of the contribution is to identify countries where marketing innovations are used the most. Researched countries have been the countries of European Union. To fulfil the main objective, secondary data from European Statistical Office (EUROSTAT) for the 2014 year were used. Marketing innovations have been increasing rapidly with the new upcoming technology and rapid changes in the smart technology. The results have shown us the most innovative countries are Germany, Turkey, Italy and France. The most popular marketing innovation are new methods of product placement.

Key words

marketing innovations, enterprises, countries of European Union

JEL Classification: O00, M31

Received: 13.09.2023 Accepted: 20.09.2023

Introduction

Marketing innovation is a key tool for businesses to expand their marketing skills and move forward. There are various marketing innovations, from product marketing innovations to process marketing innovations such as new ways of selling and paying customers. In today's world of rapidly developing technology, it is essential for businesses to adapt to the changes that exist in the market and accordingly innovate their decisions within the company. In recent years, new programs and new systems have enabled companies to communicate with customers more easily and quickly and reach them more effectively. Many new forms of trading have also emerged, such as online shopping, easier ordering, cheaper shipping methods and many others.

Within the countries of the European Union, we looked at how marketers approach marketing innovations in individual countries. Among the most innovative countries from the point of view of marketing innovations are Germany, France and Italy, whose traders devote

[1] PMVP internal grant no. I-23-109-00 of the University of Economics in Bratislava for young people teachers, researchers, and doctoral students - "Possibility of solving crisis situations in spa enterprises using innovative systems"

[1] VEGA 1/0271/23 "Sustainable renewal of spa tourism in Slovak Republic in the context of impacts of civilization crises."

[2] Ing. Henrieta Harcsová , Ekonomická univerzita v Bratislave, Obchodná fakulta, Katedra služieb a cestovného ruchu, Dolnozemská cesta 1, 852 35 Bratislava, henrieta.harcsova@euba.sk

[2] Ing. Adrián Čakanišin, Ekonomická univerzita v Bratislave, Obchodná fakulta, Katedra služieb a cestovného ruchu, Dolnozemská cesta 1, 852 35 Bratislava, adrian.cakanisin@euba.sk

a lot of time and resources to marketing innovations and adapt to changes in the market. The countries with the weakest results were mainly those with fewer traders and their size cannot compete with other countries such as Malta, Cyprus and Estonia.

Marketing innovation is often associated with a dominant technological focus, which is the basis of product or service innovation, but there is a growing trend to consider the innovation potential offered by the development of new distribution channels, brand strategies, types of communication or pricing mechanisms. Digitization, a key driver of marketing innovation, enables new communication methods, branding strategies, offer designs and transaction setups. There is a growing trend to focus on co-creation, service-dominant logic and user community perspectives. (Purchase & Thierry, 2020)

Drucker identified the two basic functions of business as marketing and innovation, rarely combining them into an integrated system. The Drucker Management system is a management philosophy whose goal is to achieve certain humanly determined values - for individuals, for organizations and for society. When using it, we always ask: how can what is right for society and individuals be right for organizations? (Maciariello, 2008)

There are several types of marketing innovation, so we will look at some of them.

A number of factors have made packaging an important marketing tool. The main function that companies have traditionally assigned to packaging has been related to the protection of products during distribution from the manufacturer to the final consumer. However, new customer needs have led to the consideration of new requirements for packaging design and the development process involving the logistics, business and environmental functions of packaging. (Rundh, 2013)

Product placement is a very specific modern marketing tool, and its use is very limited and specific and serves to "illustrate" the overall image of a company or brand. Since product placement is a very expensive tool from a financial point of view, the decision to use it must be carefully considered. If used incorrectly, large amounts of funds are wasted with zero effect. (Kramoliš & Kopečková, 2013)

Promotion carried out by the company means that the company communicates with its target market in order to arouse the interest and willingness of buyers to buy the products offered. This promotion is very important for smooth sales because without promotion, consumers do not know the product. (Nurjaya et. al., 2021) Promotional activities serve not only as a communication tool between the company and consumers, but also as a tool to influence consumers in purchasing activities or using services in accordance with their wishes and needs. (Hatta et al., 2018)

According to economic theory, price is the balance between supply and demand. This is why the pricing strategy uses the profitability turning point as the basis for innovation. For all these examples, the rule applies that the lower limit of price formation represents a turning point (return point). The price level above the turning point is formed in a variable manner influenced by the level of demand. (Ilic et al., 2014)

1 Methodology

The aim of the presented contribution is to identify countries where marketing innovations are used the most, based on the chosen methodology. Based on the main goal, the following partial goals were set:

- Identify the development of the number of enterprises that use marketing innovations in EU countries,
- Compare the results of these countries.

Based on the main and sub-objectives, the following research questions were set:

RQ_1: Which countries use the most marketing innovations?

RQ_2: Which marketing innovations are the most popular amongst the researched countries?

Several scientific methods were used in the paper. The method of deduction and induction was used primarily in obtaining secondary data and subsequently in their processing. In connection with this, an abstraction method was used, by which only relevant information, data and data were extracted. The comparison method was used in the interpretation of the obtained and identified contexts and data of the EU countries. At the end of the paper, by means of synthesis, the results were generalized, and the author's opinion was adopted.

In the first step, the research area was identified, which was narrowed down to marketing innovations in EU countries. Since marketing innovations are one of the least studied from the point of view of scientific and professional research, the marketing innovations of EU countries were accepted as the object of research. Subsequently, secondary data were obtained from available sources. Eurostat was chosen as the source of data needed for this research. The obtained data were presented through tables, graphs, but above all, the development of the number of enterprises that use marketing innovations. The conclusion of the paper contains a summary of the results and obtained data, as well as a proposal for future research.

2 Results and discussion

In the research, we focused on how many companies use marketing innovations within the countries of the European Union in the available year 2014. We consider marketing innovations to be mainly innovations that were introduced for the purpose of promoting the products and services of these companies. Among the main marketing innovations, we included changes in aesthetic design or packaging, new methods of product placement, new media or techniques for promoting products, new methods of pricing goods or services. These marketing innovations are necessary for business promotion to improve and adapt to today's innovative age where technological changes occur at a very fast pace.

The following table shows the countries of the European Union and the monitored marketing innovations in the number of companies that introduced these innovations in 2014.

Table 1 Number of enterprises of EU countries that introduced marketing innovations

	Changes in aesthetic design or packaging	**New methods of product placement**	**New media or techniques for product promotion**	**New methods of valuing goods or services**
BELGIUM	1 340	1 082	2 034	859
BULGARIA	420	359	508	428

CZECHIA	2 002	1 436	2 433	805
GERMANY	18 999	20 183	18 473	13 101
ESTONIA	152	148	172	147
GREECE	2 098	888	2 077	1 201
SPAIN	2 813	2 699	3 328	2 189
FRANCE	6 233	4 166	7 440	5 113
CROATIA	608	454	592	484
ITALY	10 313	5 813	11 103	7 156
CYPRUS	162	155	213	118
LATVIA	215	147	203	179
LITHUA-NIA	484	377	727	442
LUXEM-BURG	212	154	241	174
HUNGARY	448	369	475	420
MALTA	56	53	89	52
NETHER-LANDS	1 336	2 031	2 668	1 211
AUSTRIA	1 904	1 552	2 224	980
POLAND	1 637	1 106	1 706	1 298
PORTU-GAL	2 628	1 478	2 749	1 734
RUMUNIA	368	238	357	331
SLOVENIA	371	313	439	354
SLOVAKIA	376	211	331	190
FINLAND	795	724	1 317	871
SWEDEN	1 792	1 716	2 439	1 616
ICELAND	115	128	159	70
NORWAY	1 370	967	1 373	787
SWITZER-LAND	4 624	3 698	4 048	3 480
MACEDO-NIA	235	227	309	283
SERBIA	901	1 076	1 236	1 320
TURKEY	13 251	10 403	12 167	11 566

Source: own processing

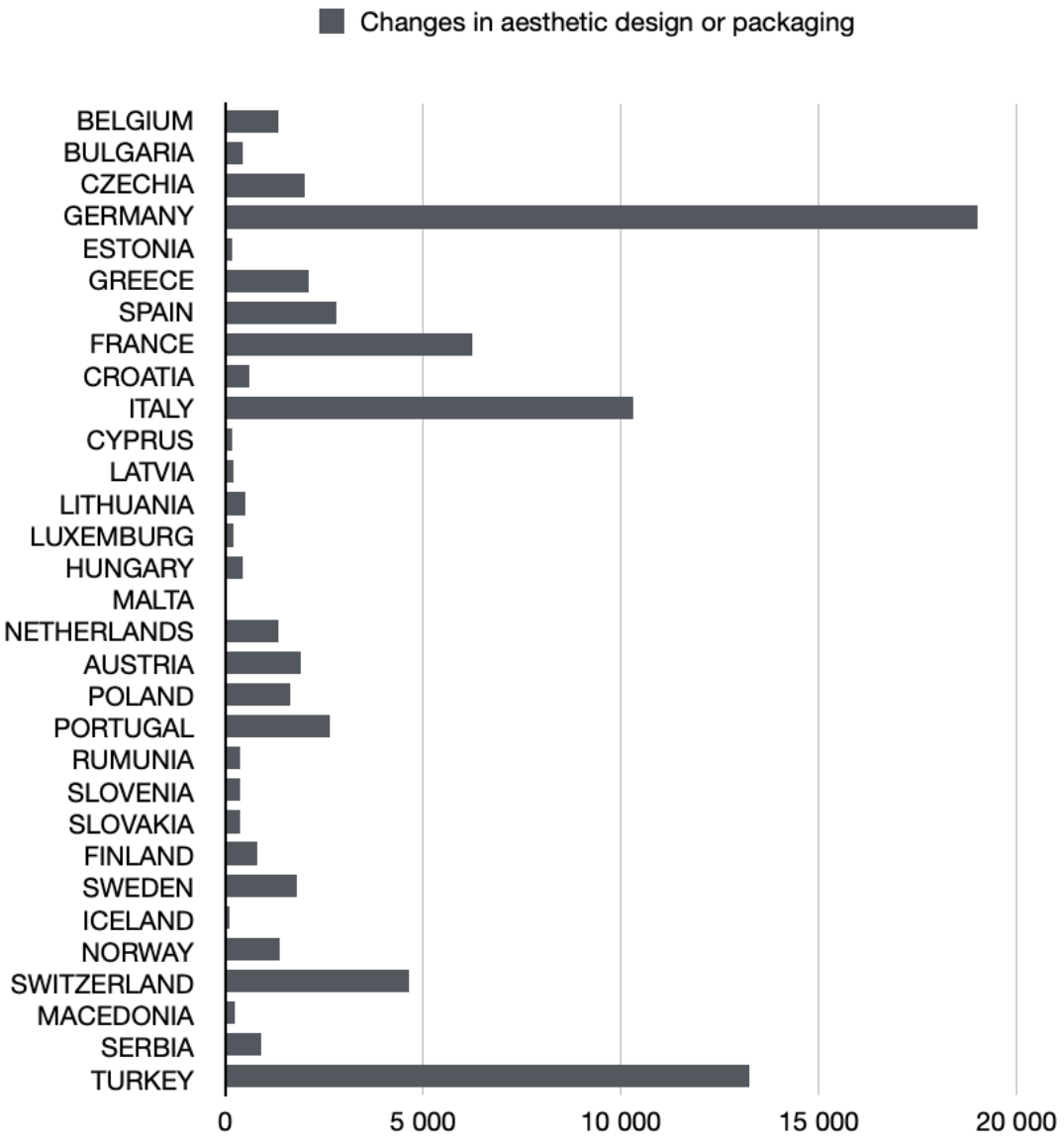
From the above table, it is clear that the most innovative country in terms of marketing innovations is Germany, with a total of 70,756 companies that introduced marketing innovations. In second place is Turkey, where 47,387 companies introduced marketing innovations in 2014. In third place is located in Italy, which has 34,385 companies that have introduced marketing innovations in a given year. The countries with the lowest number of businesses that have introduced marketing innovations are Malta, Iceland, Cyprus, Estonia and Latvia. This result may be influenced by the size of these countries and the lower number of total businesses located in those countries.

From the point of view of the most popular marketing innovations, we can evaluate that the most used marketing innovations are new media or techniques for promoting products, since in total this innovation was used in 83,630 companies. This result can be precisely

because the Internet, new social networks and new systems for promoting products are very innovative in the 21st century, and it is clear to every trader that if he wants to stay in the market and if he wants to be innovative, he must adapt to new technologies and the online world.

In the following graphic display, we can see the number of companies from European Union countries that have introduced significant changes in aesthetic design or packaging.

Figure 1 Number of EU companies that introduced significant changes in aesthetic design or packaging

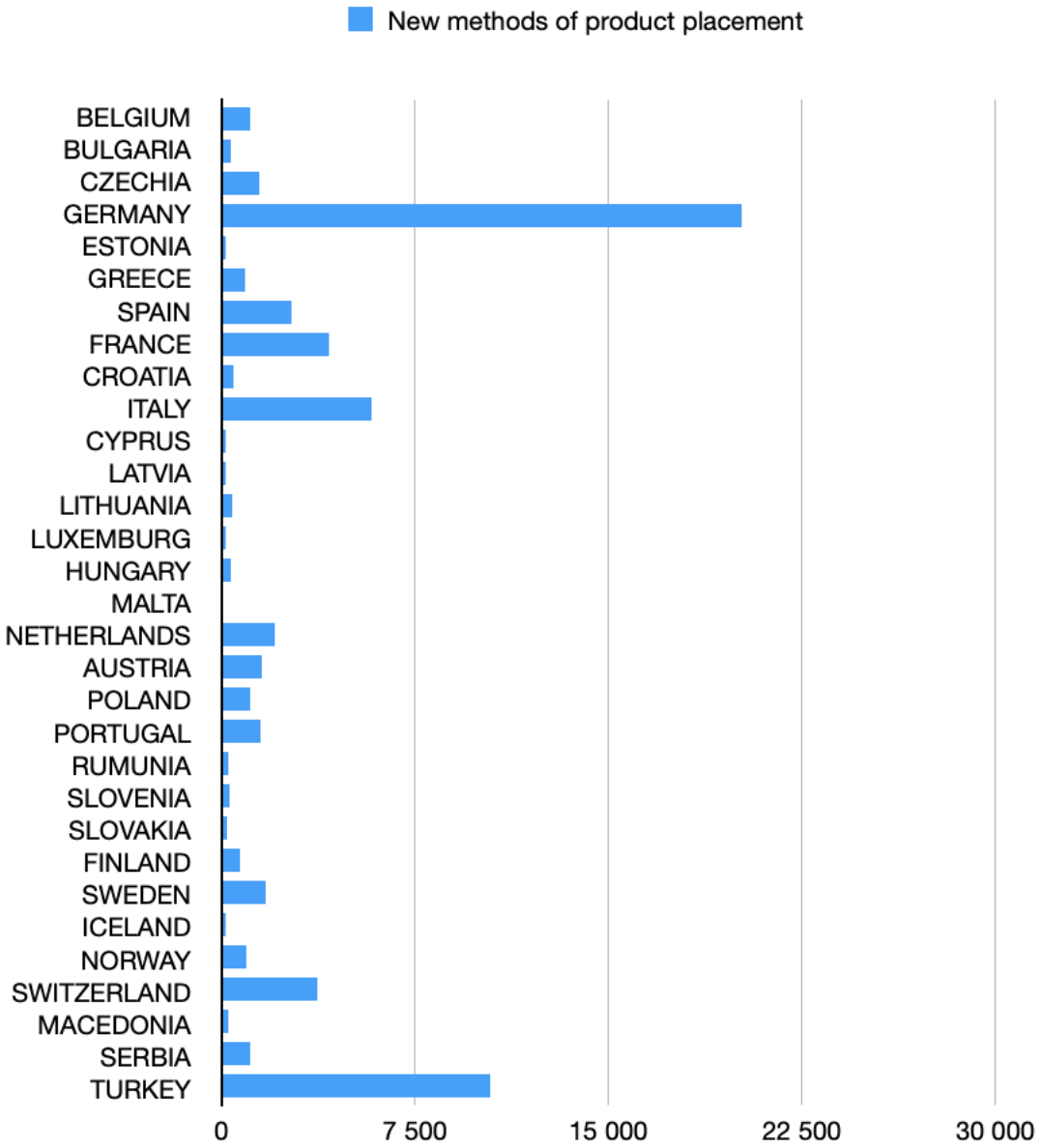


Source: own processing

According to this chart, it is clear that changes in aesthetic design or packaging have been introduced by the most businesses in the countries that have the most businesses overall that have implemented marketing innovations. These countries are Germany, Turkey and Italy. Other countries that have undertaken to introduce changes in aesthetic design or packaging are France, Switzerland, Spain and Portugal.

In the next step, we compared the number of companies from European Union countries that introduced new product placement methods in 2014. The result is shown on the following graph.

Figure 2 Number of businesses in EU countries that have introduced new product placement methods

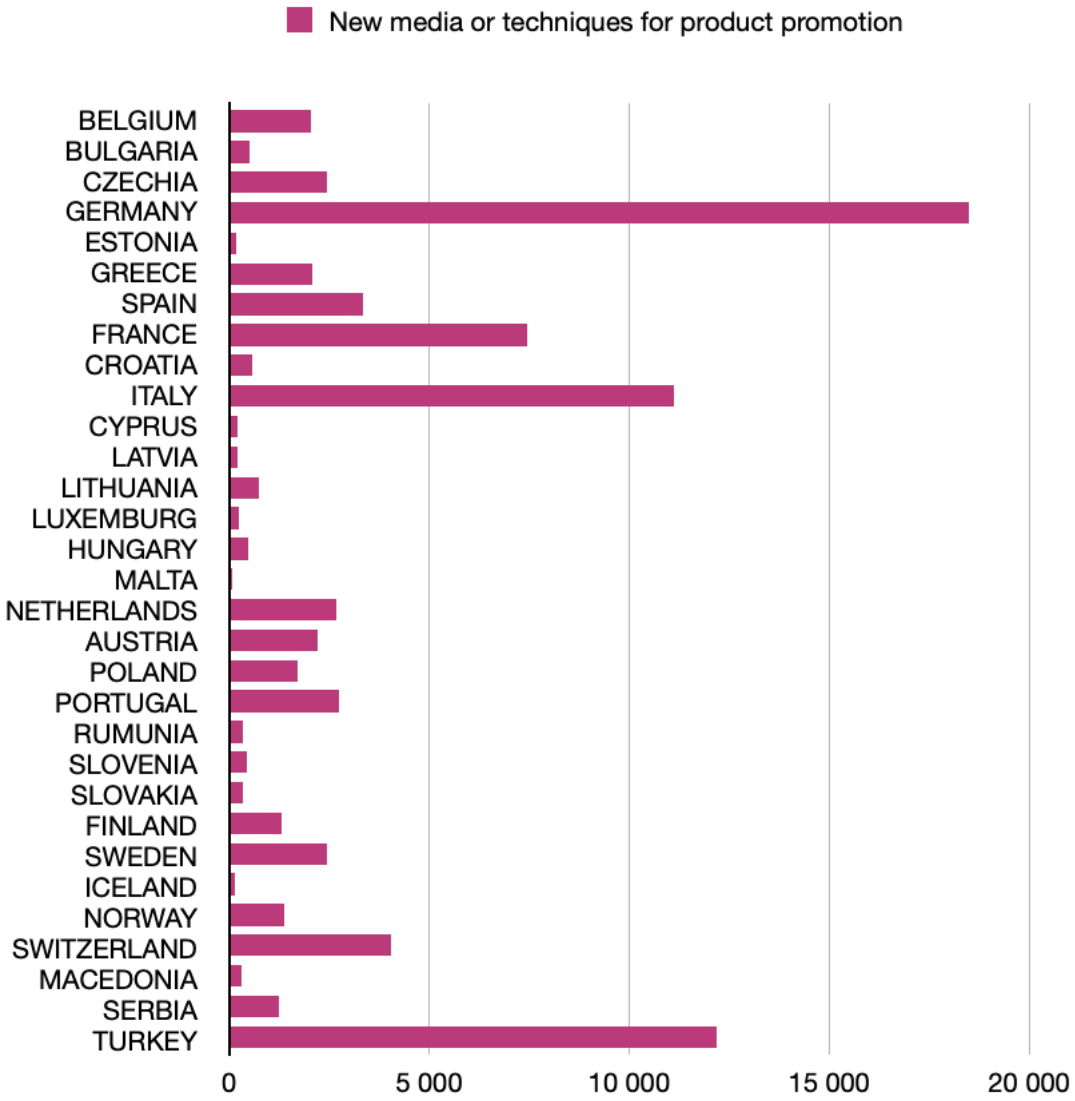


Source: own processing

Compared to graph number 1, it is clear that new methods of product placement are not so popular among companies in European Union countries, and the total number of companies that have introduced this marketing innovation is less. In most countries, the number of businesses that have focused on this marketing innovation is very few and far between. We think that nowadays, when thanks to technological innovations, shopping is moving to the online space, for them product placement is something that is not a very interesting and important solution.

In the following graph, we can see the display of the number of companies in European Union countries that have introduced new media or techniques for product promotion.

Figure 3 Number of businesses in EU countries that have introduced new media or techniques to promote products

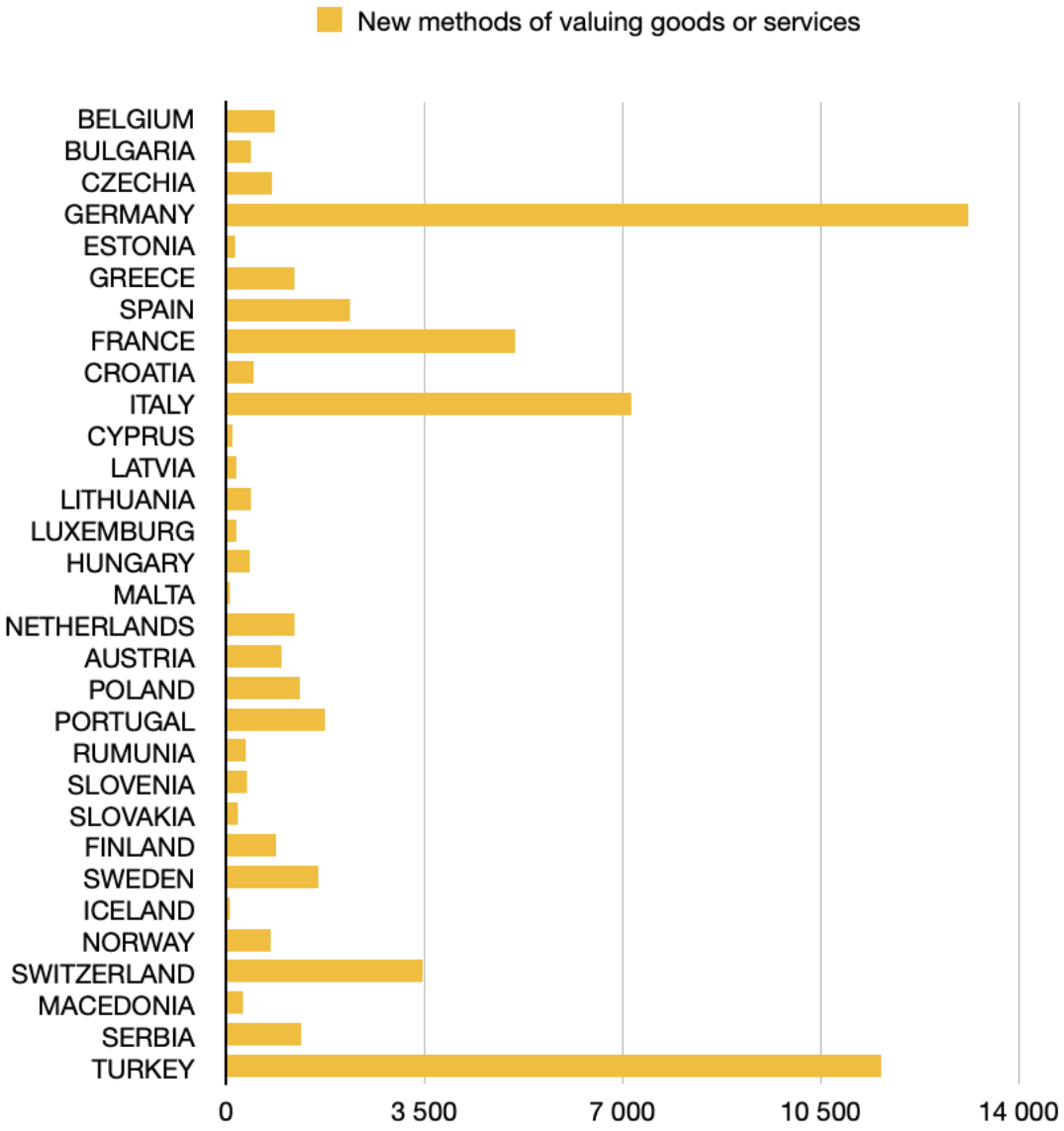


Source: own processing

It is clear from graph number 3 that, just as in the previous two cases, countries such as Germany, Turkey, Italy and France are leading in the case of new media and techniques for promoting products. However, these marketing innovations are considered very important by most countries and therefore we can see that in most countries the introduction of new media or techniques to promote products is more important than other marketing innovations. We believe that this result is influenced by many new technological innovations that force businesses to change their marketing promotion steps towards the ways that are closest to customers, namely through the Internet and social networks.

In the last step of our research, we looked at the number of businesses that introduced new methods of pricing goods or services.

Figure 4 The number of businesses in EU countries that have introduced new methods of valuing goods or services



Source: own processing

On the last examined graph, we can again see a decrease in most countries, which means that many companies do not focus on new methods of pricing goods and services, and such marketing innovations are not very important for them. However, in companies in Switzerland, it is precisely these marketing innovations that most companies participate in, and the work of new valuation methods is significant in this country and is used by many companies.

From the results that our research brought us, it is clear that the most innovative marketing countries are Germany, Turkey, Italy and France. However, this result can be distorted by the fact that there are the largest number of companies in these countries and therefore the number of companies that use marketing innovations in these countries is the highest.

Conclusion

The aim of the paper was to identify the countries where marketing innovations are used the most. The results showed us that Germany, among all the investigated countries, has the lead in terms of marketing innovations. Other countries whose marketing innovations are at the forefront are Turkey, Italy and France. These results could also have been influenced by the fact that these countries have a higher number of companies overall and therefore it is possible that these countries have the highest number of innovative companies.

The answer to research question number two, which was "Which marketing innovations are the most popular among the researched countries?" clearly points out that the most popular marketing innovation in the researched countries is the new method of product placement. New methods of product placement are important for marketers mainly because product placement methods are changing rapidly, and the marketing market is innovating and improving at a very fast pace. As the authors Kramoliš and Kopečková (2013) stated, product placement is a very specific modern marketing tool, and its use is very limited and specific and serves to "illustrate" the overall image of a company or brand. For this reason, it is essential that product placement is planned in detail and consumed in such a way that the overall image of a company or brand is improved as much as possible.

Discussion

The article was prepared on the basis of available data on marketing innovations of EU countries in the available 2014. It is advisable to continue research and marketing innovations for individual countries in the future. More up-to-date data for recent years was not available.

Acknowledgment

This study is part of the PMVP internal grant no. I-23-109-00 of the University of Economics in Bratislava for young people teachers, researchers, and doctoral students with the title "Possibility of solving crisis situations in spa enterprises using innovative systems" and VEGA 1/0271/23 "Sustainable renewal of spa tourism in Slovak Republic in the context of impacts of civilization crises."

References

Bo Rundh. (2013). Linking packaging to marketing: how packaging is influencing the marketing strategy. British Food Journal. Vol. 115. Issue 11. 1547 – 1563.

Hatta, Iha Haryani. Rachbini, Widarto. Parengrengi, Sudarmin. ANALYSIS OF PRODUCT INNOVATION, PRODUCT QUALITY, PROMOTION, AND PRICE, AND PURCHASE DECISIONS. Southeast Asia Journal of Contemporary Business, Economics and Law. Vol. 16. Issue 5.183-189.

Ilic, Dejan. Ostojic, Slavica. Damnjanovic, Nemanja. The importance of marketing innovation in new economy. Journal of applied Sciences. Vol. 11. Issue 1. 34-42.

Kramoliš, Jan. Kopečková, Martina. (2013). Product Placement: A Smart Marketing Tool Shifting a Company to the Next Competitive Level. Journal of Competitiveness. Vol. 5. Issue 4. 98-114.

Maciariello, Joseph. (2008). Marketing and innovation in the Drucker Management System. Journal of the Academy of Marketing and Science. Vol. 37. 35-43.

Nurjaya. Affandi, Azhar. Erlangga, Heri. Sunarsi, Denok. Jasmani. The Effect of Product Promotion and Innovation Activities on Marketing Performance in Middle Small Micro Enterprises in Cianjur. Budapest International Research and Critics Institute-Journal (BIRCI-Journal). Vol. 4. Issue 1. 528-540.

Purchase, Sharon. Volery, Thierry. (2020). Marketing innovation: a systematic review. Journal of Marketing Management. Vol. 36. Issue 9-10. 763-793.

A comprehensive bibliometric analysis and visualization of energy security research[1]

Yevhen Kovalenko[2], Oleksii Havrylenko[3], Artem Artyukhov[3]

Abstract

This article is devoted to the study of the main trends in the development of the concept of energy security. The purpose of the article is to analyze and summarize scientific research on the issue of ensuring the energy security of the country, to reveal the content-conceptual and evolutionary patterns of the development of the concept of energy security, to investigate the relationship between the concept of energy security and other economic categories. Methodical research tools are VOSViewer and SciVal package. The object of analysis is 36,109 publications indexed in the Scopus database for the period 1941-2022. The research information base is scientific publications indexed by Elsevier reference and bibliographic corporation. The results of the bibliometric analysis confirmed the interdisciplinary nature of energy security research, the high degree of relevance of these studies, and their close connection with a number of other categories. Based on the analysis of substantive and conceptual patterns of energy security research by the degree of their citations, eight clusters characterizing the country's energy security were identified and the most cited publications in the world were determined. It was concluded that the basis of the country's energy security growth is the development of digital technologies and artificial intelligence, alternative energy sources, computerization of monitoring and control processes over energy consumption.

Key words

energy security, visualization, energy consumption, CO2 emissions, bibliometric analysis

JEL Classification: K32, P18, Q4, B00

Received: 14.08.2023 Accepted: 18.09.2023

Introduction

Energy efficiency is one of the most cost-effective tools for reducing CO2 emissions, anthropogenic impact on the environment, combating climate change, ensuring energy security, and increasing the country's competitiveness. It is the main driver of achieving the

[1] „Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V01- 00130."

[2] Yevhen Kovalenko, Sumy State University, Ukraine, e-mail: y.kovalenko@biem.sumdu.edu.ua, https://orcid.org/0000-0002-2111-9372

[3] Oleksii Havrylenko, Sumy State University, Ukraine, e-mail: GavrilenkoAN@gmail.com, https://orcid.org/0000-0002-7276-550X

[3] Artem Artyukhov, University of Economics in Bratislava, Slovakia, e-mail: artem.artiukhov@euba.sk, https://orcid.org/0000-0003-1112-6891

long-term energy and climate goals of the EU to reduce energy consumption and increase the average temperature on Earth.

At the same time, ensuring sustainable energy development is a long-term process that provokes institutional, social, economic and environmental changes and the adoption of treaties and conventions regulating energy consumption processes at the international level. One of the indicators that most fully and thoroughly characterizes the country's energy development, the degree of compliance of its policy with European environmental goals and priorities, is the level of energy security.

The aim of this paper is to analyze and summarize scientific research on the issue of ensuring the energy security of the country, to reveal the content-conceptual and evolutionary patterns of the development of the concept of energy security, to investigate the relationship between the concept of energy security and other economic categories.

1 Data and methodology

The main hypothesis of this study is the assumption that one of the manifestations of the increasing relevance of energy development issues in the country is the growth of publication activity on these issues, in particular in publications indexed by scientific databases.

To verify the validity of the proposed hypothesis, a bibliometric analysis of the development patterns of scientific research on energy security will be carried out.

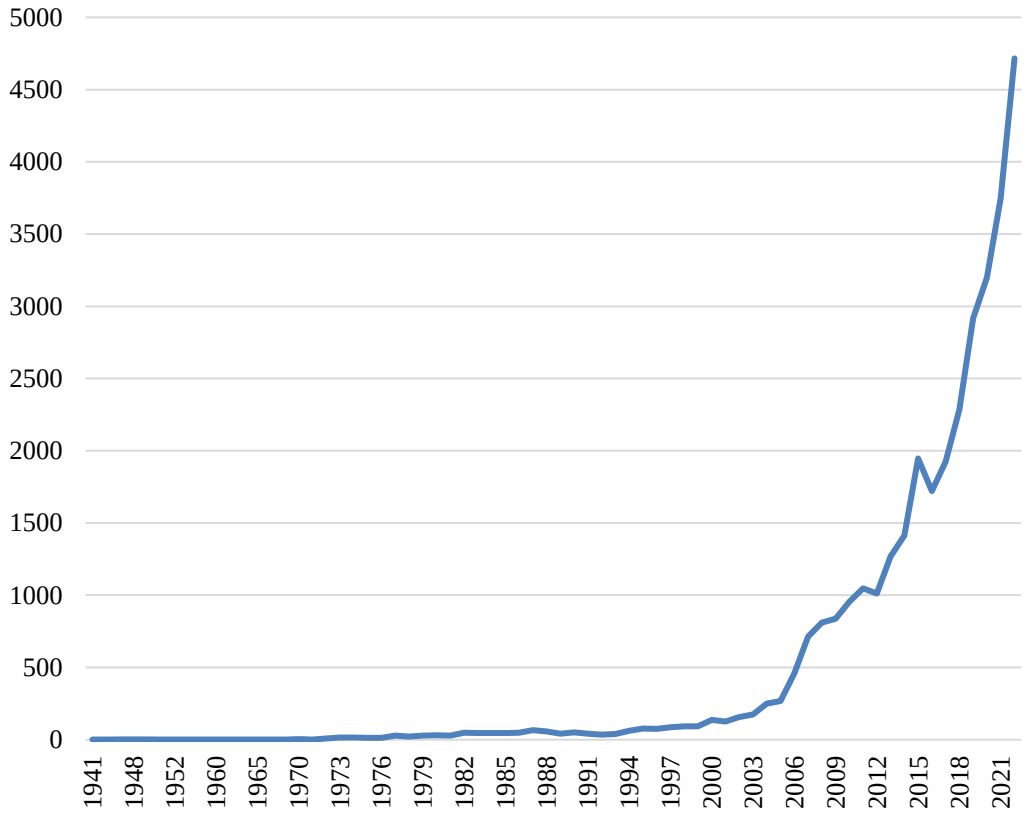
Methodical research tools are VOSViewer and SciVal package. The object of analysis is 36,109 publications in publications indexed in the Scopus database for the period 1941-2022. The research information base is scientific publications indexed by Elsevier reference and bibliographic corporation.

2 Results

The dynamics of publication activity on energy security issues shown in Figure 1 indicates a significant intensification of attention to these issues by the scientific community since 2006. The first publication on energy security issues in publications indexed in the Scopus database dates to 1941 and is devoted to the study of mechanisms (economic or military) for achieving a level of civilization higher than that existing in Western countries. The author emphasizes the existence of two types of countries: those that are ready to sacrifice food and freedom in exchange for possible achievements, worthy of their national pride, and countries that have directed their energies in a more peaceful direction, seeking to enjoy freedom and economic security, while neglecting to prepare proper protection of these privileges (Flanders, 1941). Scientific works "First report of the atomic energy commission to the security council" (1946) and "Statement by the soviet representative on the security council (Gromyko) concerning the report of the atomic energy commission" (1947) contain conclusions and recommendations for research individual elements of danger and ensuring protection against them.

After 2006, there has been a significant increase in the number of scientific works on this topic with an average relative growth rate of 13% per year, which in absolute terms amounts to 136 publications. By the end of 2022, the Scopus database had indexed 4,716 articles dealing with certain aspects of energy security.

Figure 1 Dynamics of publication activity on energy security issues in publications indexed in the Scopus database

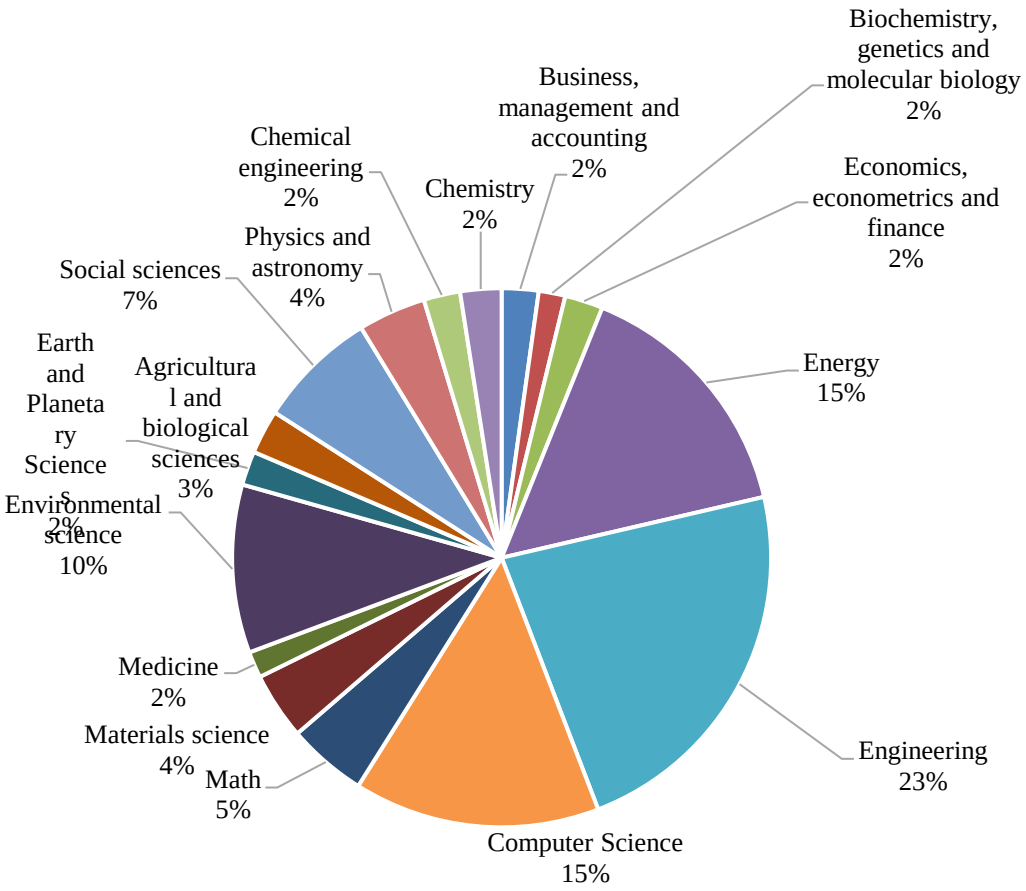


Source: Own processing according to the Scopus database

The structural analysis of publications in journals indexed in the Scopus database by fields of knowledge (Fig. 2) shows that these issues are investigated within a significant number of fields of knowledge. In addition to the direct field of knowledge "Energy" (15% of all scientific works), a significant number of scientific works were published within related fields of knowledge: "Engineering" (23%), "Computer Science" (15%), "Environmental Science" (10%), "Social Sciences" (7%), "Mathematics" (5%), etc.

Thus, it is possible to conclude about the interdisciplinary nature of research and the connection of these issues with economic, technological, medical and other aspects of the country's development.

Figure 2 Structural analysis of publication activity on energy security issues by field of knowledge in journals indexed in the Scopus database



Source: Own processing according to the Scopus database

The TOP-20 scientific journals in which scientific works on energy security issues are published (Table 1) show that, in general, the vast majority of research is published in high-rated publications characterized by a significant level of citations, a high SNIP index and SCImago rating. The largest number of scientific papers is published in the scientific publication "IEEE Access" with a SCImago rating of 0.926 and the number of citations per publication over 31.

Most of the cited publications have more than 30 citations per publication, which indicates the high interest of the world community in the obtained results.

Table 1 TOP-20 journals in which scientific works on energy security are published

	Source	Number of publications	Number of citations	Number of authors	Citation for publication	SNIP	CiteScore 2022 ranking	SCImago (SJR) magazine rating
1.	IEEE Access	553	17208	2122	31,1	1,422	9	0,926
2.	Energy Policy	408	17242	1081	42,3	2,155	15,2	2,292
3.	Energies	393	6233	1486	15,9	1,025	5,5	0,632
4.	Energy	325	12047	1126	37,1	2,132	14,9	1,989
5.	Applied Energy	293	15263	1134	52,1	2,758	21,1	2,907
6.	Journal of Cleaner Production	245	9090	998	37,1	2,379	18,5	1,981
7.	Sensors	230	5087	959	22,1	1,317	6,8	0,764
8.	Sustainability	217	4678	923	21,6	1,198	5,8	0,664
9.	IEEE Internet of Things Journal	207	8925	827	43,1	2,844	17,4	3,747
10.	Wireless Personal Communications	185	3562	492	19,3	0,908	4,5	0,545
11.	International Journal of Electrical Power and Energy Systems	153	4698	536	30,7	1,598	10,8	1,533
12.	IEEE Transactions on Power Systems	146	7663	439	52,5	2,565	15,5	3,726
13.	Renewable Energy	138	4813	473	34,9	2,146	16,1	1,815
14.	IEEE Transactions on Smart Grid	132	7519	444	57	3,197	23,6	5,118
15.	Dianli Xitong Zidonghua/Automation of Electric Power Systems	113	3389	502	30	1,286	7	0,975
16.	IEEE Transactions on Industrial Informatics	106	7190	396	67,8	3,394	22,4	4,002
17.	IEEE Transactions on Vehicular Technology	103	3015	395	29,3	2,086	13,6	2,802
18.	Energy Research and Social Science	94	2765	229	29,4	1,830	11,9	2,171
19.	Future Generation Computer Systems	93	5222	403	56,2	2,584	21,1	2,043
20.	Zhongguo Dianji Gongcheng Xuebao/Proceedings of the Chinese Society of Electrical Engineering	93	4056	409	43,6	1,313	5,7	0,953

Source: Own processing according to the Scopus database

The high rating of scientific publications is also confirmed by the inclusion of most journals in the first to fourth quartiles. According to the results of 2022 (Table 2), 1,554 out of 4,716 publications (33%) were published in journals included in Q1-Q4. Compared to 2013, the number of such publications has increased almost 2 times, which, on the one

hand, can serve as an indicator of the improvement of the quality of scientific publications, and on the other hand, the growth of the relevance of these issues and their attractiveness for the world scientific community.

Table 2 Dynamics of publication activity in journals included in the first to fourth quartiles

Year	Q1 (top 25%)	Q2 (top 26% - 50%)	Q3 (top 51% - 75%)	Q4 (top 76% - 100%)	Total
2013	479	161	100	34	774
2014	586	185	92	35	898
2015	867	282	119	32	1300
2016	761	243	102	47	1153
2017	973	215	136	53	1377
2018	1206	276	123	49	1654
2019	1507	361	140	55	2063
2020	1685	412	121	36	2254
2021	1742	443	80	23	2288
2022	1314	202	33	5	1554
Всього	11120	2780	1046	369	15315

Source: Own processing according to the Scopus database

A feature of scientific research on energy security is the high level of collaboration between scientists. 34.2% of all publications were co-authored by scientists from different countries (Table 3). This makes it possible to consider not only the national, but also the international dimension of the issues studied in the article, to exchange experience, to take into account the specifics of other countries when conducting research, which ultimately contributes to the improvement of the quality of scientific work.

Only 6.9% of articles were published under the authorship of one person, which indicates that the issue of ensuring energy security is the object of research by teams of scientists working together on this problem.

At the same time, a comparative analysis of the number of citations per publication indicates that research results obtained by groups of scientists are more attractive to the scientific community than individual publications (24.6 citations versus 38.3 citations in international cooperation). Thus, it can be concluded that the international collaboration of scientists contributes to a much wider dissemination of the obtained results and familiarization with them to a wider circle of people.

Table 3 Indicators of collaboration of scientists in the preparation of scientific works on energy security issues

Indicator	Fraction	Number of publications	Citation	Citation for publication	FWCI
International cooperation	34.2%	5380	205859	38,3	2,94
Only national cooperation	29.7%	4672	118556	25,4	1,92
Only institutional cooperation	29.2%	4585	123054	26,8	1,89
One author (no collaboration)	6.9%	1080	26592	24,6	1,77

Source: Own processing according to the Scopus database

The high relevance of energy security issues is confirmed by significant interest and support for such research at the state and international levels. Table 4 summarizes the results of international funds and organizations, with the financial support of which researches on energy security are carried out. 43.44% of all publications were made at the expense of grantors' funds. In addition to the state scientific foundations of China, Korea, the USA and Great Britain, these studies are financed by the funds of the European Commission.

Table 4 Analysis of publications on energy security by sources of their funding

	Source of funding	Number of publications
1.	National Natural Science Foundation of China	3688
2.	National Science Foundation	778
3.	National Key Research and Development Program of China	662
4.	Fundamental Research Funds for the Central Universities	589
5.	European Commission	417
6.	U.S. Department of Energy	371
7.	Horizon 2020 Framework Programme	360
8.	Engineering and Physical Sciences Research Council	349
9.	National Research Foundation of Korea	284
10.	China Postdoctoral Science Foundation	273
Total		15685

Source: Own processing according to the Scopus database

Most of the research is carried out by representatives of the Chinese academic environment. 9 out of 15 scientific institutions, the employees of which are most actively engaged in the research of energy security issues, are higher educational institutions of China (Table 5). In addition to them, the TOP-15 institutions in terms of the number of scientific works published in the period 2013-2022 and indexed in the Scopus database include the universities of India, Iran, France, Australia and Saudi Arabia.

Scientists from 34 higher educational institutions of Ukraine are engaged in research on energy security issues (Table 6). In the first place among universities of Ukraine is Sumy State University (478th place in the ranking of the organization from 16 scientific works for the period 2013-2022), in the second place (1027 in the rating) - the National Academy of Sciences of Ukraine - 8 scientific works, in the third place (1274 in the rating) - National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute" - 6 publications.

Table 5 TOP-15 institutions that are most actively engaged in the research of energy security issues.

№ п/п	Institution	Sector	Country/Region	Scholarly Output	Citations	Authors	Citations per Publication	Field-Weighted Citation Impact
1.	Chinese Academy of Sciences	government	China	384	13085	1063	34,1	2,47
2.	Tsinghua University	academic	China	277	10583	468	38,2	2,82
3.	Anna University	academic	India	259	4694	394	18,1	1,79
4.	State Grid Corporation of China	corporate	China	199	5856	399	29,4	2,16
5.	North China Electric Power University	academic	China	197	5143	413	26,1	1,89
6.	Islamic Azad University	academic	Iran	159	4256	233	26,8	2,48
7.	University of Chinese Academy of Sciences	academic	China	153	4773	329	31,2	2,45
8.	CNRS	government	France	138	4204	313	30,5	2,28
9.	Zhejiang University	academic	China	135	6094	238	45,1	3,06
10.	Xi'an Jiaotong University	academic	China	127	3773	271	29,7	2,27
11.	Shanghai Jiao Tong University	academic	China	126	3626	232	28,8	2,61
12.	University of New South Wales	academic	Australia	117	5577	126	47,7	3,57
13.	Tianjin University	academic	China	116	3460	254	29,8	2,11
14.	Vellore Institute of Technology	academic	India	113	2326	145	20,6	2,53
15.	King Saud University	academic	Saudi Arabia	113	4117	102	36,4	3,31

Source: Own processing according to the Scopus database

Table 6 TOP-10 institutions of Ukraine that are most actively engaged in researching energy security issues.

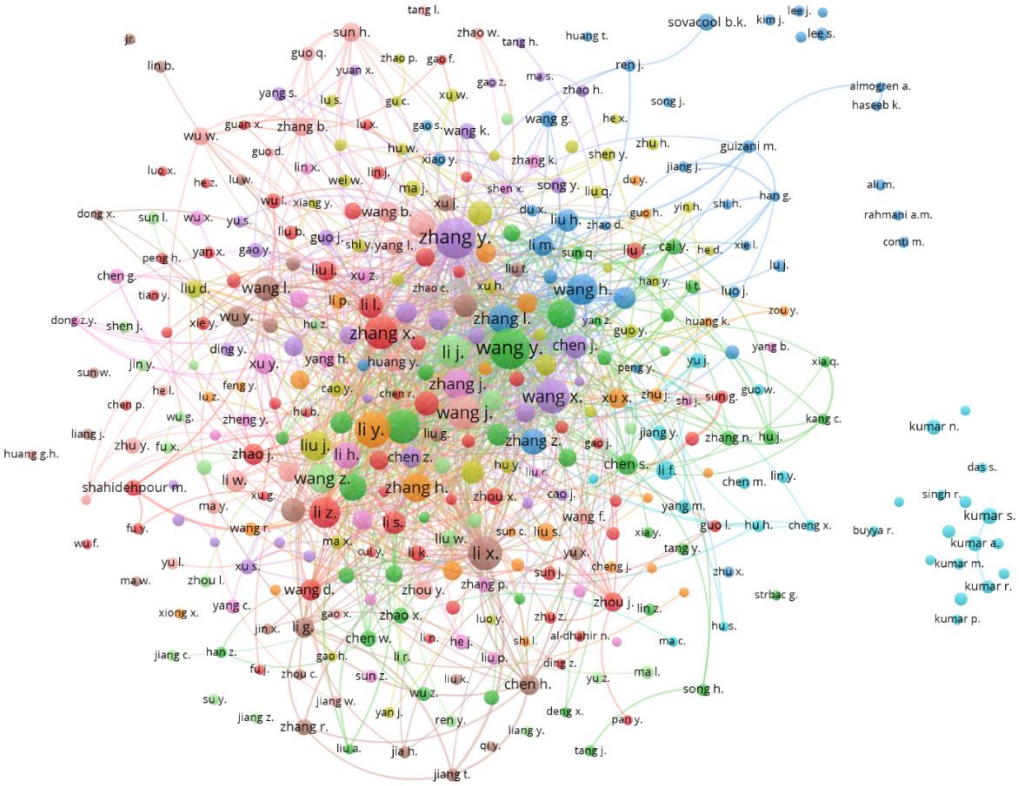
Rank	Institution	Scholarly Output	Citations	Authors	Citations per Publication	Field-Weighted Citation Impact
478	Sumy State University	16	320	25	20	2,81
1027	National Academy of Sciences of Ukraine	8	130	8	16,3	2,84
1274	National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"	6	37	9	6,2	1,07
1467	Kyiv National Taras Shevchenko University	5	123	5	24,6	3,37
1577	Ternopil National Economic University	5	42	7	8,4	1,79
1862	Vasyl Stefanyk Precarpathian National University	4	30	3	7,5	0,33
1874	Simon Kuznets Kharkiv National University of Economics	4	29	9	7,3	0,41
2037	Lviv Polytechnic National University	3	101	3	33,7	2,56
2191	Dnipro Polytechnic National Technical University	3	14	10	4,7	0,87
2235	Ivano-Frankivsk National Technical University of Oil and Gas	3	15	5	5	0,43

Source: Own processing according to the Scopus database

At the next stage, we will conduct an analysis of scientists who are most actively engaged in researching energy security issues. The sample included 367 authors who have 20 or more publications on the subject under study. The results of the bibliometric analysis presented in Figure 3 confirm the previous results regarding the high degree of cooperation of scientists. B. Chang, V. Wu, V. Lee, L. Lee, M. Shahidehpour, B. Sovakul, etc. were among the first to actively investigate the issue of energy security.

In general, 11 clusters of researchers of energy security problems can be distinguished by the number of publications on the studied issues. The largest cluster (red) unites 60 authors who have the largest number of publications, the smallest (green) unites 25 scientists.

Figure 3 Bibliometric analysis of the authors who are most actively engaged in the research of energy security issues.



Source: Own processing according to the Scopus database

The results of the bibliometric analysis allow us to form the TOP-20 scientists who were most actively engaged in the research of energy security issues in the period 2013-2022 (Table 7).

Table 7 TOP-20 scientists who were most actively engaged in researching energy security issues in the period 2013-2022.

№	Author	Scholarly Output	Last publication	Citations	Citations per publication	FWCI	h-index
1.	Shahidehpour M.	50	2022	2853	63,4	3,39	103
2.	Sovacool B. K.	41	2021	2028	49,5	2,47	86
3.	Guizani M. M.	36	2022	1813	53,3	4,06	85
4.	Sun H.	33	2022	1367	45,6	2,47	64
5.	Kumar N. S.	28	2022	1883	67,3	6,5	93
6.	Guo Q.	29	2022	1237	49,5	2,66	52
7.	Almogren A. S.	25	2022	948	37,9	3,71	44
8.	Catalão J. P.S.	23	2022	692	30,1	2,29	77

9.	Lin B.	22	2022	1034	47	3,19	87
10.	Huang G. He	22	2022	478	21,7	1,55	82
11.	Shafie-khah M.	20	2022	581	29,1	2,17	59
12.	Haseeb K.	20	2022	797	39,9	4	20
13.	Dong Z. Y.	20	2021	1418	70,9	3,61	88
14.	Choo K. K. R.	20	2022	1109	55,5	6,62	90
15.	Rodrigues J.J.P.C.	19	2022	1324	69,7	4,66	83
16.	Javaid N.	19	2022	444	23,4	3,5	58
17.	Guerrero J. M.	19	2022	830	43,7	3,27	122
18.	Chu Z.	19	2022	1004	52,8	5,47	32
19.	Mohammadi B.	19	2022	483	25,4	2,49	65
20.	Wei Z.	19	2022	716	37,7	2,25	42

Source: Own processing according to the Scopus database

M. Shahidepour has the largest number of scientific works, and in his papers, he considers the issue of coordinating the development of electricity and natural gas infrastructure to increase the variability of wind energy in electric power systems (Alabdulwahab et. al, 2015), is engaged in improving approaches to increase the stability of power grids in response to unlikely incidents with major consequences (Gholami et. al, 2014), etc.

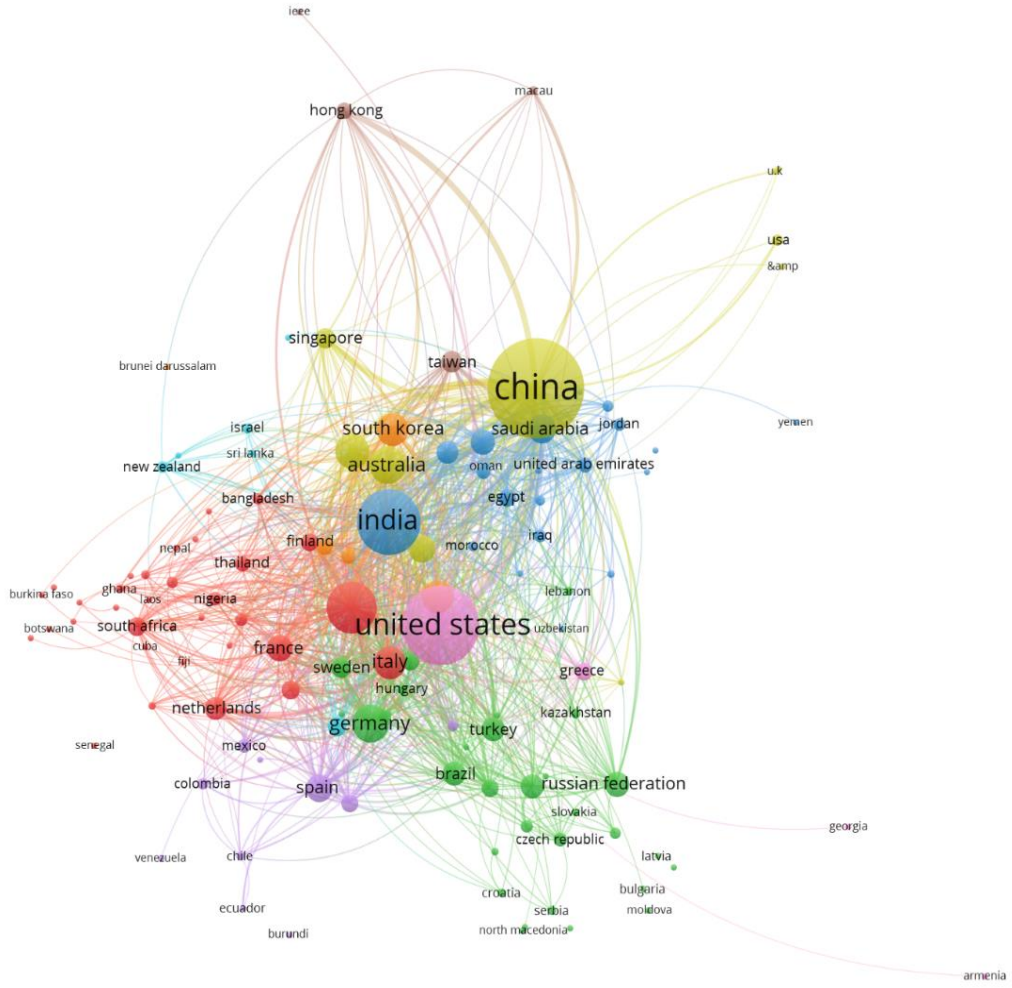
B. K. Sovacool is engaged in researching the peculiarities of the implementation of large-scale energy projects and the formation of energy policy in the countries of Northeast Asia (Cooper & Sovacool, 2013). Using the example of the Gobitec project (a project to build a multibillion-dollar solar energy system in the Gobi Desert for the export of electricity throughout Northeast Asia), the author summarizes the technical, economic, political and social barriers that arise in the process of implementing energy projects. The authors proposed an approach to the evaluation of the energy security index, which measures national indicators of energy security in retrospective dynamics. Based on the results of the analysis, the author concludes a gradual decrease in the level of energy security in the world, the existence of significant differences in the values of the energy security index between some clear leaders, such as Japan, and that the creation of energy security is a matter of both internal and external state policy.

M. Gizani is engaged in the research of technological innovations in the context of reducing the volume of energy consumption. Gouissem et. al (2022) developed a secure, energy-efficient approach for connecting Internet of Things (IoT) sensors operating with limited power resources by simultaneously optimizing energy efficiency, communication speed, and network security. In Alsamhi et al. al (2021) proved the role of unmanned aerial vehicles in greening the Internet of Things through data transmission to achieve a sustainable, reliable and ecological Industry 4.0, analyzed different use cases, systematized the challenges and opportunities of a green Internet of Things using UAVs.

One of the most cited is the work of H. Bridge et. al (2013), in which the authors consider the geographic implications of the transition to low-carbon energy. Based on an analysis of six concepts: location, landscape, territoriality, spatial differentiation, scale and spatial embeddedness, the authors illustrate what life in a low-carbon economy will be like.

In the work of Zhang et. al (2013) assessed the carbon footprint of Chinese nitrogen fertilizers, production and consumption chains. The authors emphasize that for every ton of nitrogen fertilizer produced and used in China, 13.5 tons of CO2-equivalent are emitted, compared to 9.7 tons of CO2-equivalent in Europe. Emissions from nitrogen fertilization account for about 7% of the greenhouse gas emissions of the entire Chinese economy and are several times greater than the increase in carbon in the soil as a result of the use of nitrogen fertilizers. According to the results of the study, the authors concluded that priority measures to mitigate the consequences of CO2 emissions should include improving methane extraction during coal mining, increasing energy efficiency in fertilizer production, and minimizing excessive nitrogen use in crop production at the field level.

Figure 4 Bibliometric analysis of scientific works in which energy security issues are investigated by the country of origin of the authors



Source: Own processing according to the Scopus database

An important stage of the research is the bibliometric analysis of scientific works on energy security by geographical indication. This will allow us to determine the countries whose scientists are most actively engaged in the research of this issue.

The results of the analysis presented in Figure 4 indicate that the largest number of works in publications indexed by the Scopus database were published under the co-authorship of scientists from China, the USA, India, Italy, Germany and Australia (the diameter of the circle characterizes the number of published works).

These conclusions are confirmed by the results of the ranking of countries by the number of publications in journals indexed by the Scopus database on energy security, shown in Table 8. The largest number of scientific works for the period 2013-2022 was published by scientists from China - 9164 articles, USA - 6147 articles, India - 4178 articles, Great Britain - 2602 articles and Germany - 1387 articles. Most of these works are published as co-authors of scientists from different countries.

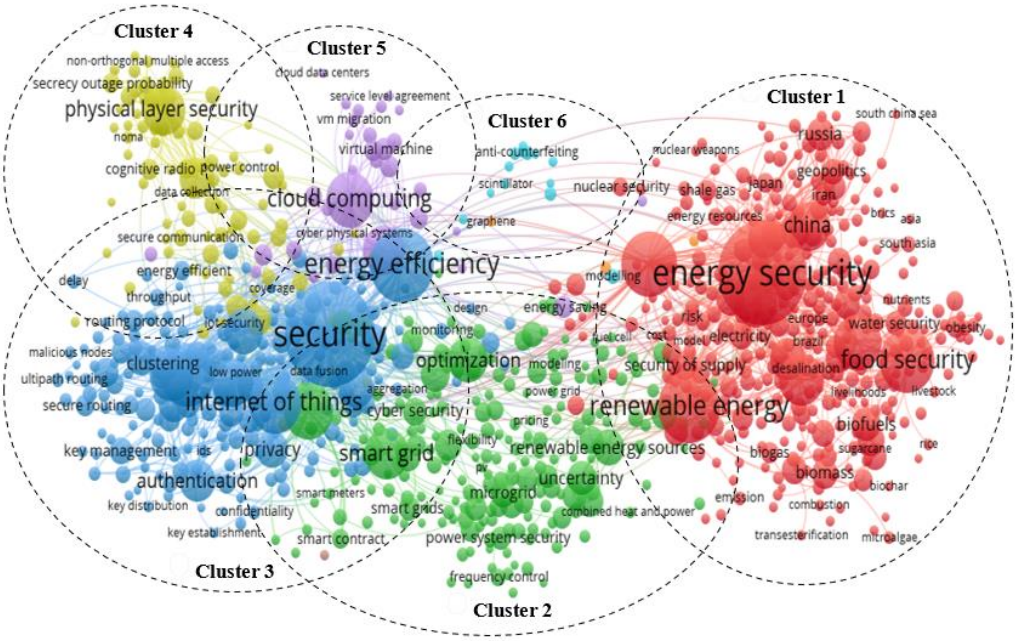
Table 8 Ranking of countries by the number of publications on energy security issues in journals indexed by the Scopus database

№	Country	Number of publications	№	Country	Number of publications
1.	China	9164	2	Saudi Arabia	878
2.	USA	6147	2	Spain	794
3.	India	4178	2	Japan	786
4.	UK	2602	2	France	724
5.	Germany	1387	2	Pakistan	656
6.	Australia	1331	2	Russian Federation	640
7.	Canada	1175	2	Poland	588
8.	Italy	1053	2	Turkey	585
9.	South Korea	1052	2	Brazil	550
10.	Iran	1011	3	Netherlands	545

Source: Own processing according to the Scopus database

At the last stage of this analysis, we will analyze the content-conceptual regularities of energy security research by the degree of their citations (Figure 5). According to the results of the analysis, 887 keywords with a frequency of citations exceeding 20 were selected and grouped into eight clusters.

Figure 5 Visualization of the most used keywords in scientific works on energy security



Source: Own processing according to the Scopus database

The largest number of keywords is the red cluster, within which energy security is considered from the point of view of the introduction of alternative energy sources (alternative fuel, bioenergy, alternative energy, clean energy, climate policy, competitiveness, decarbonization, desalination, diversification, economic security, efficiency, emissions reduction, energy crisis, energy infrastructure, energy modeling, energy planning, energy strategy, energy system, nuclear energy, nuclear safety, renewable energy, solar energy, etc.). Thus, within this cluster, the issue of finding mechanisms for reducing energy consumption using solar energy, bioenergy and other alternative energy sources is being investigated.

The green cluster contains 210 keywords related to the automation of energy consumption processes: artificial neural network, automation, blockchain technology, computer simulation, profitability analysis, critical infrastructure, cyber-attacks, cyber security, data mining, decision making, distributed generation, distributed energy resources, electronic power system, energy hub, energy management, forecasting, game theory, industry 4.0, integrated energy systems, linear programming, neural network, numerical modeling, optimization, energy generation, power quality, reliable optimization. Within this cluster, the reduction of energy consumption is considered from the point of view of the use of the latest technologies, automation of energy consumption control processes, its forecasting and optimization.

Similar to green is the blue cluster (199 keywords), characterized by the study of energy consumption in connection with the use of computer technologies and various software. The following keywords are used within this cluster: ad hoc networks, architecture, attack, block cipher, Bluetooth low energy, cloud security, connectivity, cryptography, data integrity, deep neural network, fuzzy logic, hardware security, intrusion detection, IoT security, machine learning, wireless security, security network.

The yellow cluster includes the following keywords: beamforming, cognitive radio, convex (digital ultrasound system) optimization, data collection, eavesdropping, energy detection, federated learning, full duplex, physical layer security, power distribution, q-learning, energy efficiency secrecy, unmanned aircraft, unreliable relay, wireless communication, wireless energy transfer.

The lilac cluster includes 32 keywords exploring the interaction of energy consumption and the development of virtual technologies: cloud computing, cloud data centers, energy optimization, green computing, hybrid, operational migration, load balancing, power management, resource utilization, server consolidation, virtual machine, virtualization, placement of a virtual machine, migration of a virtual machine.

The turquoise cluster includes the following keywords: energy transfer, modeling, anti-counterfeiting, national security, image processing, luminescence, nanoparticles, neutron detection, photoluminescence, scintillator, up conversion, x-ray, x-ray imaging.

The orange cluster includes publications in which issues of increasing the efficiency of individual energy sources due to the use of innovative, ecological, and resistant to various influences technologies are investigated. The following keywords belong to this cluster: new energy, graphene, energy independence.

The brown cluster, the smallest in terms of volume, investigates the specifics of using triboelectric nanogenerators in the process of creating energy.

Thus, the results of the conducted analysis testify to the close connection of energy security with several other categories, which indicates the interdisciplinary nature of these studies and their high degree of relevance. Most of the clusters identified by us connect energy security with the development of digital technologies and artificial intelligence, alternative energy sources, computerization of processes of monitoring and control of energy consumption.

Conclusion

Thus, the results of the conducted analysis proved the significant relevance of the issues of ensuring the country's energy security. Based on the results of a structural analysis of publication activity in the publications indexed in the Scopus database on energy security by field of knowledge, a conclusion about the interdisciplinary nature of these studies and their close connection with economic, technological, medical, and other aspects of the country's development was made. The study of the authors' collectives of publications devoted to energy security issues by their affiliation confirmed the high level of their international collaboration. Most scientific works are devoted to taking into account the international dimension of the researched issues and taking into account the specifics of building the energy policy of several countries of the world.

References

Alabdulwahab, A., Abusorrah, A., Zhang, X., & Shahidehpour, M. (2015). Coordination of interdependent natural gas and electricity infrastructures for firming the variability of wind energy in stochastic day-ahead scheduling. IEEE Transactions on Sustainable Energy, 6(2), 606-615. http://dx.doi.org/10.1109/TSTE.2015.2399855

Alsamhi, S. H., Afghah, F., Sahal, R., Hawbani, A., Al-qaness, M. A. A., Lee, B. & Guizani, M. (2021). Green internet of things using UAVs in B5G networks: A review of applications and strategies. Ad Hoc Networks, 117. http://dx.doi.org/10.1016/j.adhoc.2021.102505

Bridge, G., Bouzarovski, S., Bradshaw, M., & Eyre, N. (2013). Geographies of energy transition: Space, place and the low-carbon economy. Energy Policy, 53. , 331-340. http://dx.doi.org/10.1016/j.enpol.2012.10.066

Cooper, C. & Sovacool, B. K. (2013). Miracle or mirage? The promise and peril of desert energy. Part 1. Renewable Energy, 50, 628-636. http://dx.doi.org/10.1016/j.renene.2012.07.027

First report of the atomic energy commission to the security council, december 30, 1946 (1947). International Organization, 1(2), 389-394. http://dx.doi.org/10.1017/S0020818300006378

Flanders, D. P. (1941). Planning and low-rent housing. Social Forces, 19(3), 337-345. http://dx.doi.org/10.2307/2570735

Gholami, A., Shekari, T., Aminifar, F., & Shahidehpour M. (2014). Microgrid scheduling with uncertainty: The quest for resilience. IEEE Transactions on Smart Grid, 7(6), 2849-2858. http://dx.doi.org/10.1109/TSG.2016.2598802

Gouissem, A., Abualsaud, K., Yaacoub, E., Khattab, T. & Guizani, M. (2022). A secure energy efficient scheme for cooperative IoT networks. IEEE Transactions on Communications, 70(6), 3962-3976. http://dx.doi.org/10.1109/TCOMM.2022.3165887

Sovacool, B. K. (2013). An international assessment of energy security performance. Ecological Economics, 881, 48-158. http://dx.doi.org/10.1016/j.ecolecon.2013.01.019

Statement by the soviet representative on the security council (gromyko) concerning the report of the atomic energy commission, March 5, 1947. (1947) International Organization, 1(2), 395-408. http://dx.doi.org/10.1017/S002081830000638X

Zhang, W. F., Dou, Z. X., He, P., Ju, X. T., Powlson, D., Chadwick, D., et al. (2013). New technologies reduce greenhouse gas emissions from nitrogenous fertilizer in china. Proceedings of the National Academy of Sciences of the United States of America, 110(21), 8375-8380. http://dx.doi.org/10.1073/pnas.1210447110

Change in the structure of Ukrainian foreign trade against the background of decreasing efficiency of logistics[1]

Yuliia Yehorova[2]

Abstract

The growing risks of international trade allow logistics to play a vital role in today's environment. The problem of the impact of logistics efficiency on exports, imports, and other indicators of trade performance is becoming increasingly relevant. The aim of the paper is to determine the change in the structure of Ukrainian foreign trade against the background of decreasing efficiency of logistics. The methods used for the research include analysis, synthesis, comparison, induction, and deduction. The efficiency of Ukraine's logistics system was assessed and compared with other countries using the logistics performance index. To achieve the goal of the paper, an analysis of statistical data on the dynamics of exports and imports in Ukraine for 2015–2022 was carried out. It is shown that the deterioration of logistics after 2014 is accompanied by a change in the geographical structure of Ukraine's foreign trade, in the direction of an increase in trade turnover with European countries and a decrease with the countries of CIS. The results can be used as a basis for future research.

Key words

export, foreign trade, import, international trade, logistics performance index, Ukraine

JEL Classification: F14, R40

Received: 10.09.2023 Accepted: 20.09.2023

Introduction

In the context of globalization, international trade is the most important component of the economic development of countries around the world. Trade between countries (export, import, and transit) cannot be carried out without effective logistics and developed logistics infrastructure. In this regard, the issue of the influence of logistics on the performance of international trade is becoming increasingly relevant in scientific research.

This paper is devoted to the study of changes in the geographical structure of foreign trade and the commodity structure of Ukraine's exports in the context of declining logistics efficiency.

[1] Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V01-00042

[2] Yuliia Yehorova, Doc., PhD., University of Economics in Bratislava, Faculty of Commerce, Research Institute of Trade and Sustainable Business, Dolnozemská cesta 1, 852 35 Bratislava, Slovak republic, e-mail: yuliia.yehorova@euba.sk

1 Methodology

The aim of the paper is to determine the change in the structure of Ukrainian foreign trade against the background of decreasing efficiency of logistics. To achieve this goal, the work included an assessment of the efficiency of logistics, an analysis of changes in foreign trade by geographic region, and the commodity structure of exports in Ukraine.

The assessment of logistics efficiency in Ukraine was carried out using the logistics performance index (LPI), which is the most objective indicator in this area. The period of the research included 2012, 2014, 2016, 2018, and 2023, due to the frequency of data provided by the World bank. The lack of data for 2020 is due to the pandemic COVID -19 and a restructuring of the index methodology. The study of the LPI made it possible to identify ten countries that were the leaders in the ranking. To conduct a comparative analysis of logistics indicators in 2023, four countries were selected from among them: Singapore, Germany, the Netherlands, and Belgium, which are constantly among the top ten. To determine trends in the development of logistics in Ukraine, the work analyses the dynamics of logistics indicators for the period from 2012 to 2023. The analysis of Ukraine's foreign trade by geographical regions covers the period from 2015 to 2022, owing to the desire to make an economic and statistical assessment of the changes that have occurred in connection with a decrease in logistical efficiency. The work also examines the change in the commodity structure of Ukrainian exports in 2022 compared to 2021, which occurred due to the deterioration of logistics.

The work uses analysis, synthesis, comparison, induction, and deduction methods. The main source of information on the level of development of logistics is the logistics performance index, calculated and published by the World bank. In addition, data from the State Statistics Service of Ukraine and the Ministry of Economy of Ukraine formed the information base for the study. Microsoft Excel software was used for data processing.

2 Results and Discussion

Many scientific studies use the logistics performance index (LPI) to analyse the quality of goods supply processes and the state of logistics on a national and international level (Arvis et al., 2018; Çemberc et al., 2015; Roy et al., 2018).

Martí et al. (2014) highlight the importance of the logistics performance index in international trade. The results of their study show that improving any of the components of the LPI can lead to a significant increase in a country's trade flows. The paper by Mačiulytė-Šniukienė & Burinskienė (2020) confirms that changes in logistics efficiency are positively associated with the flow of international trade in EU member states, but that this impact varies across countries.

According to Song and Lee (2022), the components of the logistics performance index (LPI) are generally significant for international trade, but the priority of their influence depends on the positions of imports and exports. A more detailed study of the impact of logistics efficiency on international trade, based on the use of LPI data for 60 countries over 4 years (2007, 2010, 2012, 2014), shows the importance of the impact of logistics development indices on export and import values. The models consider changes in relative prices, the presence of a common border with the main trading partner, a common language with

the main partners, participation in the WTO, and the speed of delivery. At the same time, it was found that the development of logistics has a greater impact on exports than on imports (Gani, 2017). According to Shepherd (2016), positive effects on exports and trade facilitation can be achieved through improved logistics efficiency.

In general, improved logistics performance in trading countries leads to increased bilateral trade and reduced trade costs (Bugarčić et al., 2020). Arvis et al. (2012) also argue that transport and logistics contribute as much to the costs of international trade as geographical distance. At the same time, inefficient logistics leads to increased costs, delivery times, and financial resources, which negatively impact countries and companies (Alassane et al., 2020).

Despite numerous scientific works in this field, the issue of changing the structure of international trade under the conditions of decreasing logistic efficiency has not yet been sufficiently considered.

3 The evaluation of logistics performance in Ukraine

The methodology for assessing the level of logistics development was first developed by the World Bank in 2007 and involves calculating the logistics performance index (LPI) based on surveys of international, national, or regional logistics operators and freight forwarding companies (World Bank, 2007). It is calculated as a weighted average of six logistics operations. Performance is rated on a 5 points scale.

Analysis of data on international trade logistics for 2012, 2014, 2016, 2018, and 2023 allows us to identify ten leading countries in the LPI ranking in each year.

Tab. 1 10 leading countries in the LPI ranking

2012		2014		2016		2018		2023	
Country	LPI score	Country	LPI score	Country	LPI score	Country	LPI score	Country	LPI score
Singapore	4,13	Germany	4,12	Germany	4,23	Germany	4.2	Singapore	4.3
Hong Kong, China	4.12	Netherlands	4,05	Luxembourg	4,22	Sweden	4.05	Finland	4.2
Finland	4,05	Belgium	4,04	Sweden	4,2	Belgium	4.04	Denmark	4.1
Germany	4.03	United Kingdom	4,01	Netherlands	4,19	Austria	4.03	Germany	4.1
Netherlands	4,02	Singapore	4	Singapore	4,14	Japan	4.03	Netherlands	4.1
Denmark	4.02	Sweden	3,96	Belgium	4,11	Netherlands	4.02	Switzerland	4.1
Belgium	3.98	Norway	3,96	Austria	4,1	Singapore	4	Austria	4

Japan	3.93	Luxem-bourg	3,95	United Kingdom	4,07	Denmark	3.99	Belgium	4
United States	3,93	United States	3,92	Hong Kong, China	4,07	United Kingdom	3.99	Sweden	4
United Kingdom	3,9	Japan	3,91	United States	3,99	Finland	3.89	Hong Kong, China	4

Source: own processing based on data of the World bank

The places of countries in the LPI ranking are constantly changing based on the measures taken to improve logistics activities, but in the analysed years, Singapore, Germany, the Netherlands, and Belgium are constantly in the top ten (see the Table 1).

The logistics performance index allows you not only to determine the current position of a country in the ranking but also to track its trends over time.

Tab.2 Logistics performance indicators in Ukraine, 2012-2023

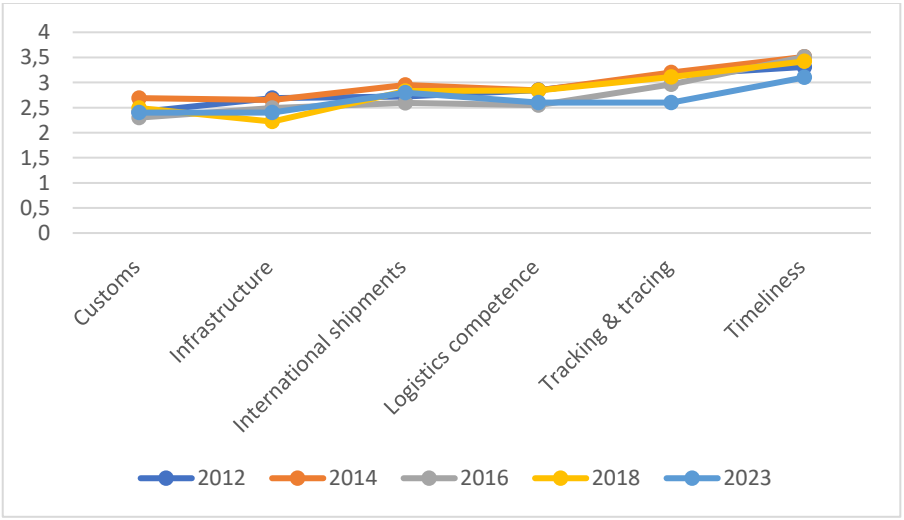
Indicators	2012	2014	2016	2018	2023
LPI Rank	66	61	80	66	79
LPI Score	2.85	2.98	2.74	2.83	2.7
Customs	2.41	2.69	2.3	2.49	2.4
Infrastructure	2.69	2.65	2.49	2.22	2.4
International shipments	2.72	2.95	2.59	2.83	2.8
Logistics competence	2.85	2.84	2.55	2.84	2.6
Tracking & tracing	3.15	3.2	2.96	3.11	2.6
Timeliness	3.31	3.51	3.51	3.42	3.1
Total number of countries in the ranking	155	160	160	160	139

Source: own processing based on data of the World bank

According to Table 2 the most successful year in terms of logistics for Ukraine was 2014. It took 61st place in the ranking of 160 countries with an LPI score of 2.98. At the same time, the most developed components of the logistics system were "Customs" (2.69), "International shipments" (2.95), "Tracking & tracing" (3.2), and "Timeliness" (3.51). In 2016, there was a decrease of 19 positions, and Ukraine moved from 61st to 80th place in the ranking. Despite the improvement in the situation in 2018 to 66th place in the ranking, the subsequent COVID-19 pandemic, and the outbreak of hostilities in 2022 caused a decrease in logistics indicators in 2023.

Analysing the dynamics of logistics efficiency in Ukraine, it should be noted that after 2014 there has been a downward trend in all indicators. At the same time, the most significant deterioration occurred in the indicators "Tracking & tracing" from 3.2 points in 2014 to 2.6 in 2023 and "Timeliness" from 3.51 points to 3.1 (see Graph 1).

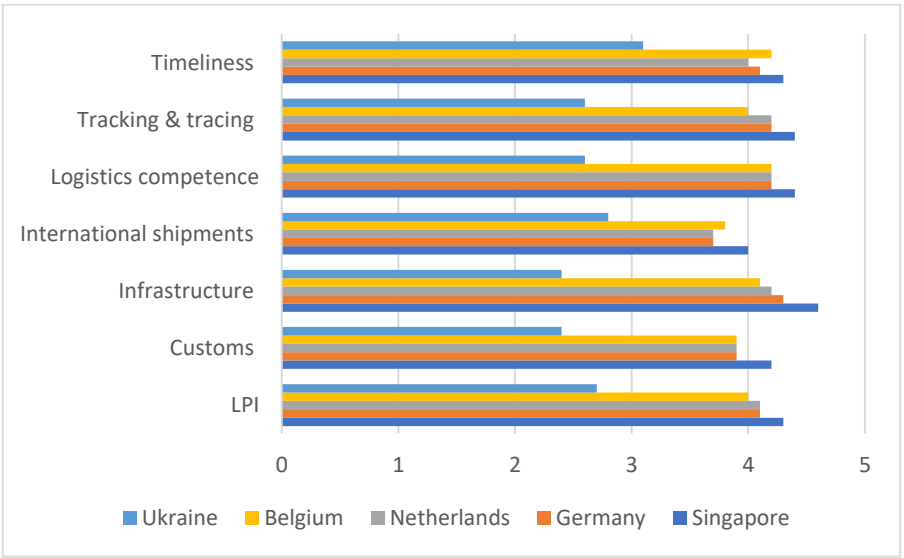
Graph 1 Dynamics of logistics efficiency indicators in Ukraine, 2012–2023



Source: own processing based on data of the World bank

The logistics performance index (LPI) not only allows countries to identify the challenges and opportunities they face in trade logistics but also provides an interactive benchmarking tool.

Graph 2 Logistics efficiency indicators of the leading countries in the LPI ranking and Ukraine, 2023



Source: own processing based on data of the World bank

An analysis of the logistics performance indicators of Ukraine and the leading countries in the ranking in 2023 shows a significant lag in all six key parameters (see Graph 2). The

largest gap is observed in the indicators "Customs" (2.4 points in Ukraine, 3.9–4.2 points in leading countries), "Infrastructure" (2.4 points in Ukraine, 4.1–4.6 points in leading countries), "Logistic competence" (2.6 points in Ukraine, 4.2–4.4 points in leading countries), and "Tracking & tracing" (2.6 points in Ukraine, 4–4.4 points in leading countries). The difference in other indicators is "International shipments" (2.8 points in Ukraine, 4.2–4.4 points in leading countries) and "Timeless" (3.1 points in Ukraine, 4–4.3 points in leading countries).

In general, the low efficiency indicators of international logistics in Ukraine in 2023 can be explained by the following problems:

- in the field of transport logistics: transport and technical infrastructure destroyed because of military operations, limited railway communication, and lack of air transportation; high risks of cargo loss; irrational routes of material flows; administrative and customs barriers.
- in the field of production logistics: the severance of economic ties and the need to search for new channels for the supply of raw materials and components, outdated production technologies.
- in the field of warehouse logistics: lack of investment in the development of the transport and warehouse complex, lack of modern logistics centres, low quality of logistics services provided.
- in the field of distribution logistics: restrictions in international trade due to the loss of markets for products and a significant reduction in the geography of supplies.

4 Change in the structure of Ukrainian foreign trade

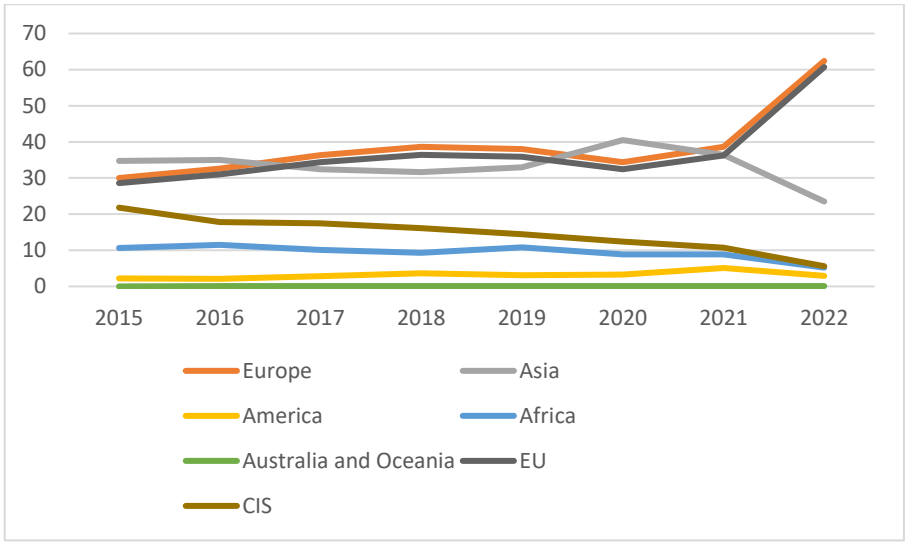
A country's foreign trade largely depends on the efficiency of logistics and the level of integration with trading partners. Logistics disruptions, under the influence of various factors, lead to changes in the structure of foreign trade. Over the past few years, the dynamics of Ukraine's export-import operations across geographic regions has changed significantly.

Analysing the dynamics of Ukrainian goods exports by geographic region for 2015–2022, it should be noted that the most pronounced trend is the growing share of Europe, namely the European Union, in Ukraine's goods exports in 2022 (see Graph 3). If during the period from 2015 to 2021 the EU share in exports fluctuated between 30–40%, then in 2022 it amounted to 62.4%. A significant increase in exports in 2022 is directly related to temporary easier access to the EU market, thanks to the abolition of import customs duties as well as tariff quotas for Ukrainian goods for one year. It is natural in the current socio-economic and geopolitical conditions to reduce the share of CIS countries in Ukraine's exports from 21.8% in 2015 to 5.2% in 2022.

In addition, a decrease in merchandise exports is observed in Asia and Africa. At the same time, the share of exports to Asia fluctuated between 30 and 40% during 2015–2021, and in 2022 it decreased to 23.5%. The reduction in exports to African countries almost halved (from 10.6% in 2015 to 5.2% by 2022). As for other geographical regions, here the share of Ukraine's merchandise exports is insignificant—on average, about 3% to America and 0.1% to Australia and Oceania.

The European Union's role as a trading partner in imports has also increased, but not to the same extent as in exports (see Graph 4). In 2015, the EU share in Ukraine's imports was 32.7%, and by 2022, it had increased to 44.5%.

Graph 3 Dynamics of Ukrainian goods exports by geographic region, 2015-2022, % of total



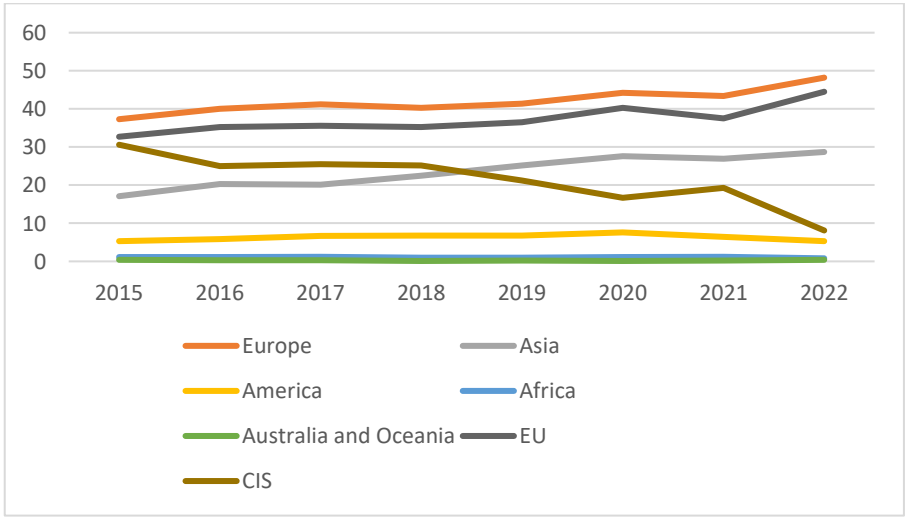
Notes: separately EU and CIS

Since 2014, data has been provided without considering the temporarily occupied territory of Ukraine

Source: own processing based on data of the State Statistics Service of Ukraine and the Ministry of Economy of Ukraine

A growth trend in imports of goods is observed in the Asian region, from 17.1% in 2015 to 28.7% in 2022.

Graph 4 Dynamics of imports of goods from Ukraine by geographic region, 2015-2022, % of total



Notes: separately EU and CIS

Since 2014, data has been provided without considering the temporarily occupied territory of Ukraine

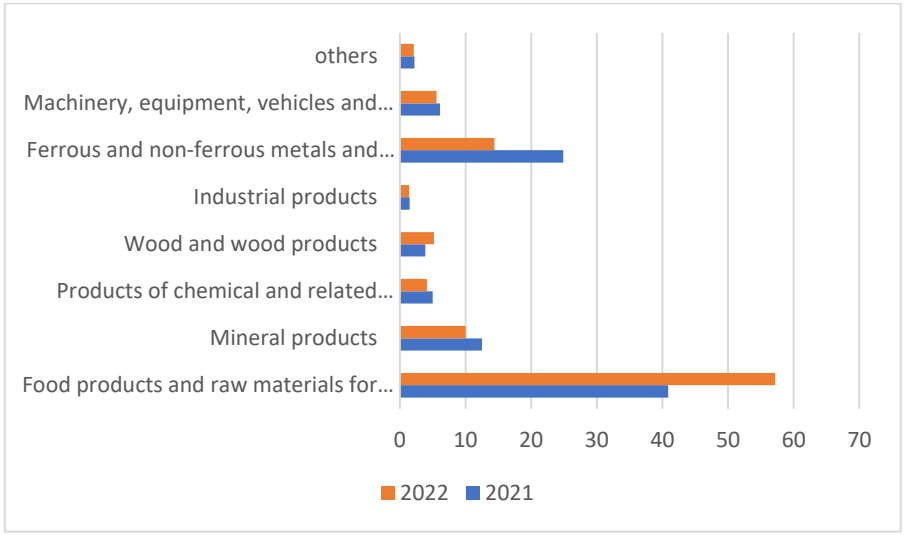
Source: own processing based on data of the State Statistics Service of Ukraine and the Ministry of Economy of Ukraine

Among other important trends, it should be noted a significant reduction in the share of merchandise imports from CIS countries to Ukraine from 30.6% in 2015 to 8.1% in 2022. The shares of other geographical regions in merchandise imports, as well as in exports, are insignificant (America - on average 6%, Africa - 1%, Australia and Oceania - 0.1%).

The commodity structure of Ukraine's foreign trade has also changed under the influence of logistics problems. It is known that logistics plays a vital role in expanding the geography of product exports. However, in the current socio-economic and geopolitical conditions, we must talk about ensuring Ukraine's exports as one of the ways for the state to survive. It should be noted that the commodity structure of imports is currently not sufficiently informative due to the significant amount of humanitarian goods.

According to data from the Ministry of Economy of Ukraine (2022), overall exports of goods in 2022 amounted to $44.1 billion and decreased by 35.1% compared to 2021. The main reasons for the reduction in exports were the destruction of warehouses and production facilities, as well as the blocking of the main seaports of Mykolaiv, Odessa, and Mariupol (Hryniv & Ravlikovska, 2022).

Graph 5 Change in the commodity structure of Ukraine's exports in 2022 compared to 2021, %



Notes: since 2014, data has been provided without considering the temporarily occupied territory of Ukraine

Source: own processing based on data of the of the State Statistics Service

Traditionally, food products and raw materials for their production occupied a significant place in Ukraine's exports. Logistics restrictions and the restructuring of commodity flows led to an increase in their share in the export structure from 43.9% in 2021 to 57.2% in 2022 (see Graph 5). This was facilitated by the implementation of the Black Sea Grain Initiative, because of which the activities of three Ukrainian ports were unblocked (United Nations, 2023). In addition, there is a slight increase in the export of wood and wood products by 1.3%.

A sharp reduction in the export of ferrous and non-ferrous metals and products made from them from 24.9% to 14.4% was a consequence of the loss of production capacity and

the shutdown of many enterprises in the industry (Azovstal, Zaporizhstal, etc.). In addition, in 2022, there was a decrease in exports of mineral products by 2.5%, products of chemical and related industries by 0.9%, industrial products by 0.1%, and machinery, vehicle equipment, and instruments by 0.5%.

Conclusion

The goal of the work has been achieved. An assessment of logistics efficiency showed that the most successful year for Ukraine was 2014, in which it took 61st place in the ranking of 160 countries with an LPI value of 2.98 points. After this, there is a decrease in almost all logistics indicators by an average of 0.3 points. Despite the improvement in the logistics situation in 2018, the subsequent COVID-19 pandemic and the outbreak of hostilities in Ukraine led to a further drop in all indicators. At the same time, the most significant decrease occurred in the indicators "Tracking & tracing" from 3.2 points in 2014 to 2.6 points in 2023 and "Timeliness" from 3.51 points in 2014 to 3.1 points in 2023.

A study of international trade logistics data for 2012, 2014, 2016, 2018, and 2023 identified the top ten LPI countries in each year. It has been established that the top ten countries consistently include Singapore, Germany, the Netherlands, and Belgium. A comparative analysis of the logistics indicators of Ukraine and these countries demonstrated a significant lag in the current level of efficiency. Low indicators in Ukraine in 2023 are mainly associated with problems in the areas of transport, warehouse, production, and distribution logistics.

A country's foreign trade largely depends on the efficiency of logistics and the level of integration with trading partners. An analysis of the structure of Ukraine's foreign trade by region revealed a narrow geography of markets and showed that the export and import of goods are concentrated in European countries. The share of the EU in merchandise exports increased from 36.2% in 2021 to 60.7% in 2022, and in imports from 43.4% to 44.5%. At the same time, the significant growth of Ukrainian exports in 2022 was directly related to the temporarily facilitated access to the EU market, which was adopted in 2021. Logistical difficulties associated with the blocking of seaports and the limited capacity of land routes have led to a reduction in the share of Africa and Asia in Ukraine's commodity exports. However, the share of Asian countries, and above all China, in imports continues to grow. The most important trend in Ukraine's foreign trade is a significant decrease in trade turnover with CIS countries, which began in 2015 and continues to this day. The share of CIS countries in exports decreased from 21.8% in 2015 to 5.6% in 2022, in imports - from 30.6% to 8.1%. Simultaneously with the realignment of commodity flows comes their restructuring. In the commodity structure of Ukrainian exports in 2022, the share of food and raw materials for their production, as well as the share of wood and products made from it, increases slightly compared to 2021. At the same time, the share of other goods in Ukrainian exports has decreased.

Based on the results of the study, the main conclusion can be drawn that in the current socio-economic and geopolitical conditions, the change in the structure of Ukraine's foreign trade is fully consistent with the state of the country's logistics.

References

Alassane, D. Y., Aimin, D., Todine, Y. N. (2020). The Effect of Infrastructure and Logistics Performance on Economic Performance: The Mediation Role of International Trade. *Foreign Trade Review*. 55(4), 39-47.

Arvis, J.-F., Mustra, M., Ojala, L., Shepherd, B., Saslavsky, D. (2012) *Connecting to Compete: Trade Logistics in the Global Economy*. World Bank, Washington, DC.

Arvis, J.-F., Ojala, L., Wiederer, Ch., Shepherd, B., Raj, A., Dairabayeva, K., & Kiiski, T. (2018). *Connecting to compete. Trade logistics in the global economy. Logistics performance index and its indicators.* World bank, Washington, DC.

Bugarčić, F., Skvarciany, V. & Stanišić, N. (2020). Logistics performance index in international trade: case of Central and Eastern European and Western Balkans countries. *Business: Theory and Practice*. 21. 452–459.

Çemberci, M., Civelek, M. E., & Canbolat, N. (2015). The moderator effect of global competitiveness index on dimensions of logistics performance index. In *Procedia – Social and Behavioral Sciences*, 195, pp. 1514–1524.

Gani, A. (2017). The Logistics Performance Effect in International Trade. *Asian Journal of Shipping and Logistics*. 33(4). 279-288.

Hryniv, N., Ravlikovska, A. (2022). Reconstruction of logistics in the conditions of marital state in Ukraine. In *Academic vision*, 13. Retrieved September 20, 2023, from https://academy-vision.org/index.php/av/article/download/84/74

Maciulyte-Sniukiene, A. & Burinskiene, A. (2020). Logistics and international trade development relationship: evidence of European Union member states. In *11th International Scientific Conference "Business and Management*, Vilnius, Lithuania, pp. 19-28.

Martí, L., Puertas, R., & García, L. (2014). The importance of the Logistics Performance Index in international trade. *Applied Economics*, 46(24), 2982–2992.

Ministry of Economy of Ukraine. Retrieved September 12, 2023, from https://www.me.gov.ua/Documents/List?lang=uk-UA&id=e3c3c882-4b68-4f23-8e25-388526eb71c3&tag=TendentsiiEksportuInfografika

Roy, V., Mitra, S. K., Chattopadhyay, M., & Sahay, B. S. (2018). Facilitating the extraction of extended insights on logistics performance from the logistics performance index dataset: A two-stage methodological framework and its application. *Research in Transportation Business and Management*, 28, 23–32.

Shepherd, B. (2016). Infrastructure, trade facilitation, and network connectivity in Sub-Saharan Africa. *Journal of African Trade*, 3(1/2), 1-22.

Song, M-J., Lee, H-Y. (2022). The relationship between international trade and logistics performance: A focus on the South Korean industrial sector. *Research in Transportation Business & Management*, 44.

State Statistics Service of Ukraine. Retrieved September 12, 2023, from https://ukrstat.gov.ua.

United Nations. *Global perspectives*. Retrieved September 18, 2023, from https://news.un.org/en/

World Bank. *Logistic performance index*. Retrieved September 10, 2023, from https://lpi.worldbank.org/international/global