

THE DEVELOPMENT OF EXPORT-IMPORT ACTIVITY ON THE BASIS OF INFORMATION AND COMMUNICATION TECHNOLOGIES

©2023 MALYARETS L. M., NORIK L. A., BALIUK Y. S., BUDARIN O. S.

UDC 339.5

JEL Classification: D83; O31

Malyarets L. M., Norik L. A., Baliuk Y. S., Budarin O. S.

The Development of Export-Import Activity on the Basis of Information and Communication Technologies

Information and communication technologies (ICT) are rapidly becoming a decisive factor and driving force for the development of export-import activities of many enterprises. The aim of the article is to identify the main directions of development of export-import activities on the basis of ICT and to assess the relationship between the indicators of the digital economy and the indicators of exports and imports of the EU countries. In this study, based on the analysis of statistical data of the leading European countries-leaders in the field of exports and imports, the features of their export-import activities are highlighted, the degrees of use of ICT in various sectors of the economy of these countries are analyzed, the most important directions of use of ICT for the development of export-import activities are allocated, namely: digital infrastructure: electronic documentation, electronic exchange of information, e-commerce, digital innovations in the manufacturing, digital finance, digital marketing and promotion, digital logistics, cybersecurity. The allocated areas should serve as a guideline for the resumption of Ukraine's foreign trade during the wartime and in the post-war period. Taking into consideration data of the EU countries, an analysis of the impact of the indicators of the components of the index of digital economy and society on the volume of exports and imports in 2022 is carried out on the basis of regression models. It is substantiated that the effect of the use of ICT will strengthen our country's position in the competitive field of international trade. For the leading countries of exports and imports, it is determined that the introduction of 5G technology is of significant importance in the context of the development of foreign trade, which at present is an urgent and strategic direction for the development of these countries. Further direction of development of this study is envisaged in the study of models of dynamics and the inclusion of additional factors influencing foreign trade, namely human potential, financial and material support for the introduction of ICT based on the experience of leading European countries.

Keywords: exports, imports, information and communication technologies, European experience, Digital Economy Index.

DOI: <https://doi.org/10.32983/2222-0712-2023-4-22-31>

Fig.: 7. **Tabl.:** 1. **Bibl.:** 25.

Malyarets Lyudmyla M. – Doctor of Sciences (Economics), Professor, Head of the Department of Mathematics and Mathematical Economic Methods, Simon Kuznets Kharkiv National University of Economics (9a Nauky Ave., Kharkiv, 61166, Ukraine)

E-mail: malyarets@ukr.net

ORCID: <https://orcid.org/0000-0002-1684-9805>

Researcher ID: <https://www.webofscience.com/wos/author/record/T-9858-2018>

Scopus Author ID: <https://www.scopus.com/authid/detail.uri?authorId=57189248374>

Norik Larisa A. – Candidate of Sciences (Economics), Associate Professor, Associate Professor of the Department of Mathematics and Mathematical Economic Methods, Simon Kuznets Kharkiv National University of Economics (9a Nauky Ave., Kharkiv, 61166, Ukraine)

E-mail: larisa.norik@gmail.com

ORCID: <https://orcid.org/0000-0002-7077-1260>

Baliuk Yuliia S. – Postgraduate Student of the Department of Mathematics and Mathematical Economic Methods, Simon Kuznets Kharkiv National University of Economics (9a Nauky Ave., Kharkiv, 61166, Ukraine)

E-mail: ulabaluk@gmail.com

ORCID: <https://orcid.org/0009-0005-1125-6567>

Budarin Oleksii S. – Postgraduate Student of the Department of Mathematics and Mathematical Economic Methods, Simon Kuznets Kharkiv National University of Economics (9a Nauky Ave., Kharkiv, 61166, Ukraine)

E-mail: budarin@ukrenergymachines.com

ORCID: <https://orcid.org/0000-0001-9399-9914>

УДК 339.5

JEL Classification: D83; O31

Маларець Л. М., Норік Л. О., Балюк Ю. С., Бударін О. С. Розвиток експортно-імпоротної діяльності на основі інформаційно-комунікаційних технологій

Інформаційно-комунікаційні технології (ІКТ) стрімко стають вирішальним фактором і рушійною силою розвитку експортно-імпоротної діяльності багатьох підприємств. Мета статті полягає у визначенні основних напрямків розвитку експортно-імпоротної діяльності на основі ІКТ та оцінюванні зв'язку між показниками цифрової економіки та показниками обсягів експорту й імпорту країн ЄС. У цьому дослідженні на підставі аналізу статистичних даних провідних європейських країн-лідерів у сфері експорту й імпорту висвітлено особливості їх експортно-імпоротної діяльності.

проаналізовано ступені використання ІКТ у різних секторах економіки цих країн, виокремлено найбільш важливі напрями використання ІКТ щодо розвитку експортно-імпоротної діяльності, а саме: цифрова інфраструктура: електронна документація, електронний обмін інформацією, електронна комерція, цифрові інновації на виробництві, цифрові фінанси, цифровий маркетинг і просування, цифрова логістика, кібербезпека. Виділені напрями мають слугувати орієнтиром відновлення зовнішньої торгівлі України у воєнний та повоєнний періоди. За даними країн ЄС проведено аналіз впливу показників складових індексу цифрової економіки та суспільства на обсяги експорту й імпорту у 2022 р. на підставі регресійних моделей. Обґрунтовано, що ефект від використання ІКТ дозволить підсилити позиції країни на конкурентному полі міжнародної торгівлі. Для країн-лідерів експорту й імпорту встановлено, що суттєве значення у контексті розвитку зовнішньої торгівлі має впровадження технології 5G, яке сьогодні є актуальним і стратегічним напрямком розвитку цих країн. Подальший напрямком розвитку цього дослідження передбачається у вивченні моделей динаміки та включенні додаткових факторів впливу на зовнішню торгівлю, а саме людського потенціалу, фінансового та матеріального забезпечення впровадження ІКТ виходячи з досвіду провідних європейських країн.

Ключові слова: експорт, імпорт, інформаційно-комунікаційні технології, європейський досвід, індекс цифрової економіки.

Рис.: 7. Табл.: 1. Бібл.: 25.

Маларець Людмила Михайлівна – доктор економічних наук, професор, завідувач кафедри вищої математики та економіко-математичних методів, Харківський національний економічний університет імені Семена Кузнеця (просп. Науки, 9а, Харків, 61166, Україна)

E-mail: malyarets@ukr.net

ORCID: <https://orcid.org/0000-0002-1684-9805>

Researcher ID: <https://www.webofscience.com/wos/author/record/T-9858-2018>

Scopus Author ID: <https://www.scopus.com/authid/detail.uri?authorId=57189248374>

Норік Лариса Олексіївна – кандидат економічних наук, доцент, доцент кафедри вищої математики та економіко-математичних методів, Харківський національний економічний університет імені Семена Кузнеця (просп. Науки, 9а, Харків, 61166, Україна)

E-mail: larisa.norik@gmail.com

ORCID: <https://orcid.org/0000-0002-7077-1260>

Балюк Юлія Сергіївна – аспірант кафедри вищої математики та економіко-математичних методів, Харківський національний економічний університет імені Семена Кузнеця (просп. Науки, 9а, Харків, 61166, Україна)

E-mail: ulabaluk@gmail.com

ORCID: <https://orcid.org/0009-0005-1125-6567>

Бударін Олексій Сергійович – аспірант кафедри вищої математики та економіко-математичних методів, Харківський національний економічний університет імені Семена Кузнеця (просп. Науки, 9а, Харків, 61166, Україна)

E-mail: budarin@ukrenergymachines.com

ORCID: <https://orcid.org/0000-0001-9399-9914>

Introduction. The development of export-import activity is a determinant of the country's development and determines its entry into the world economic space. The growth of globalization of the economy leads to an increase in the volume of international trade. From 1980 to 2022 the volume of world trade increased by 7.8 times, and the volume of world GDP – by 4.1 times [1]. Enterprises engaged in export-import activities face high competition in international markets, which requires the use of appropriate tools that will provide new opportunities in foreign markets, allow timely identification of demand for their products and compete effectively.

As world experience shows, today information and communication technologies (ICT) are becoming a decisive factor in the development of export-import activities of many global industrial enterprises. The growth in the number of online trading platforms indicates their great demand in global markets. One of the largest electronic trading platforms in the world, the Chinese company group Alibaba Group has created an effective communication infrastructure that facilitates global trade. The American company Amazon, through the use of ICT, ensures the optimization of logistics processes, effectively manages inventory and the construction of an international network of suppliers, and is a leader in the field of e-commerce. Japan's Toyota Motor Corporation uses ICT to optimize production

and logistics at its facilities around the world, which helps ensure the supply of products to international markets. One of the world's leading aircraft manufacturers, Boeing uses ICT at various stages of aircraft production and delivery. The international conglomerate Schneider Electric (France) is actively implementing such ICT as monitoring and collecting equipment data, developing digital platforms for remote energy saving management of its customers, designing the automation of production processes and energy system management in businesses around the world. These examples prove that world leaders in various industries use ICT to develop export-import activities and successfully compete in international markets. Ensuring the efficiency of export-import activities and their effective management requires enterprises to be flexible, adapt to changes in the international environment and introduce innovative technologies, among which information and communication technologies (ICT) are a modern and innovative mechanism for the development of export-import activities.

Analysis of publications. The article [2] considers the issue of the impact of ICT on changes in the indicators of exports and imports of goods and proposes to take this into account when calculating and forecasting changes in the indicators of foreign trade security of the State. Kulhanik O. M. [3] draws attention to the reason that in the process of increasing the ex-

port potential, Ukraine should take into account the national interest and apply promising instruments of the development used by the largest export-oriented countries. The monograph [4] examines the features of modern ICT and their role in the development of the digital economy, identifies the factors of influence of digitalization processes on the results of economic activity, quantifies the transformational potential of digitalization of the Ukrainian economy and substantiates recommendations for its improvement. Zhang X. and Wang Y. [5] analyzed the mechanism of influence of the level of digital technologies and political constraints on the development of trade in digital services. The authors of the paper [6] considered the degree of influence of the level of openness of the ICT market on trade activities. J. Wagner [7] researched the impact of information technology such as a company's website on the activation of export and import operations and cooperation with international partners. The monograph [8] considers the model approach in the study of the export-import potential and evaluates the development of the commodity structure of exports and imports of Ukraine. Stanislavky O. and Kovalenko O. [9] examined the problematic aspects of the development of export activities under martial law in the context of the State support for domestic enterprises. Among the measures to ensure foreign trade operations, the authors highlighted the activation of digitalization of business processes and the involvement of electronic services, which will significantly simplify export procedures. The article [10] analyzes the intensity of exports of Chinese firms based on the use of the Internet and proves that the use of Internet technologies contributes to increasing the degree of integration between enterprises by optimizing the distribution of resources in the domestic and foreign markets and increases

the overall economic efficiency. Bushovska L. B., Poplavska O. V., Yadukha S. [11] identified the conditions that prove the need to develop a mechanism for managing export-import operations and its importance in ensuring the economic security of enterprises. Thus, the analysis of contemporary scientific works related to the development of export-import activities indicates that the study of the practical aspects of the use of ICT in foreign trade is relevant and requires further research.

The aim of the article is to determine the directions of development of export-import activities on the basis of ICT and to assess the relationship between the digital economy and the volumes of exports and imports of the EU countries.

Results. In the presented study, based on the analysis of statistical data of the advancing European countries-leaders in the sphere of export and import, the features of their export-import activities are highlighted, the degrees of use of ICT in various sectors of the economy of these countries are analyzed, the most important directions of the use of ICT in terms of the development of export-import activities are allocated and an analysis of the impact of both the indicators of the components of the digital economy and the society index on the volume of exports and imports in 2022 is carried out on the basis of regression models according to the data of the EU countries, thus providing to identify and evaluate promising ways to restore Ukraine's foreign economic activity in the conditions of martial law and concerning the post-war state.

According to UNCTAD (United Nations Conference on Trade and Development) [12], which regularly publishes statistics on global trade, one can observe the dynamics of growth rates of exports and imports of goods in the world and in Ukraine (Fig. 1–2).

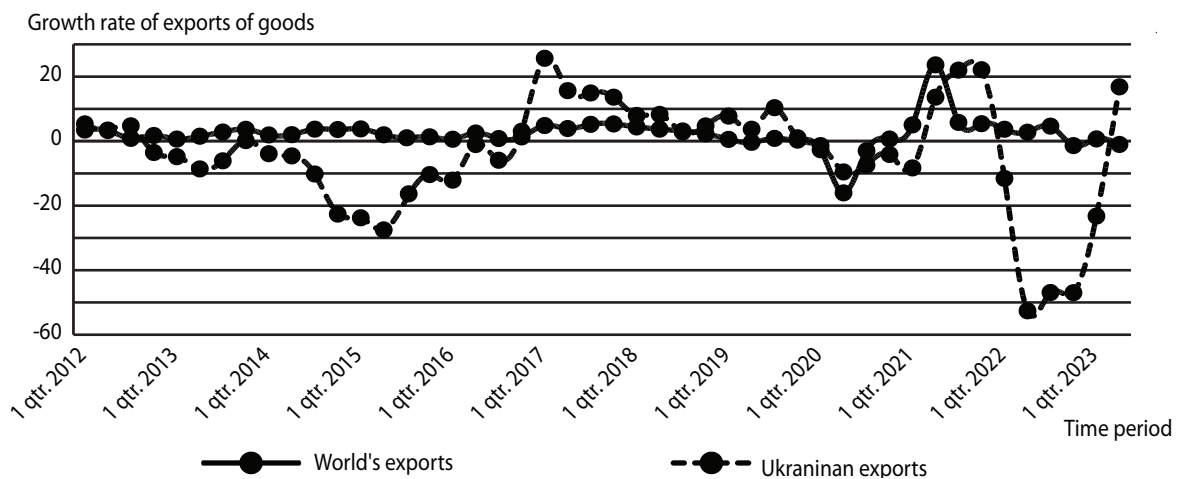


Fig. 1. Changes in the growth rate of exports of goods

Source: compiled from data of [12]

According to Fig. 1, Fig. 2, the unstable nature of changes in the growth rates of exports and imports of goods in Ukraine is observed. The Russian aggression since 2014 and the full-scale invasion in 2022 have certainly had a significant impact on the foreign economic activity of Ukraine. However, in some periods, when even the world economy in the wake of the COVID-19 pandemic showed a decrease in the growth rate of exports and imports of goods, Ukraine kept the pace of change from decreasing. A certain level of the formed pre-war export-import potential of Ukraine and the support of international

partners allowed our country to resist in the difficult conditions of Russian aggression and continue to carry out foreign economic operations. «As a result of the rupture of logistics routes, trade in 2022 sharply reoriented to the EU countries and, in particular, to the closest neighbors (Poland, Romania, Hungary, Slovakia, Bulgaria)» [13, p. 6]. Post-war recovery and ensuring the development of our country's economy requires the use of modern instruments of world foreign trade. The formation of export-import relations of domestic enterprises requires the determination of the most effective ways and means of ensur-

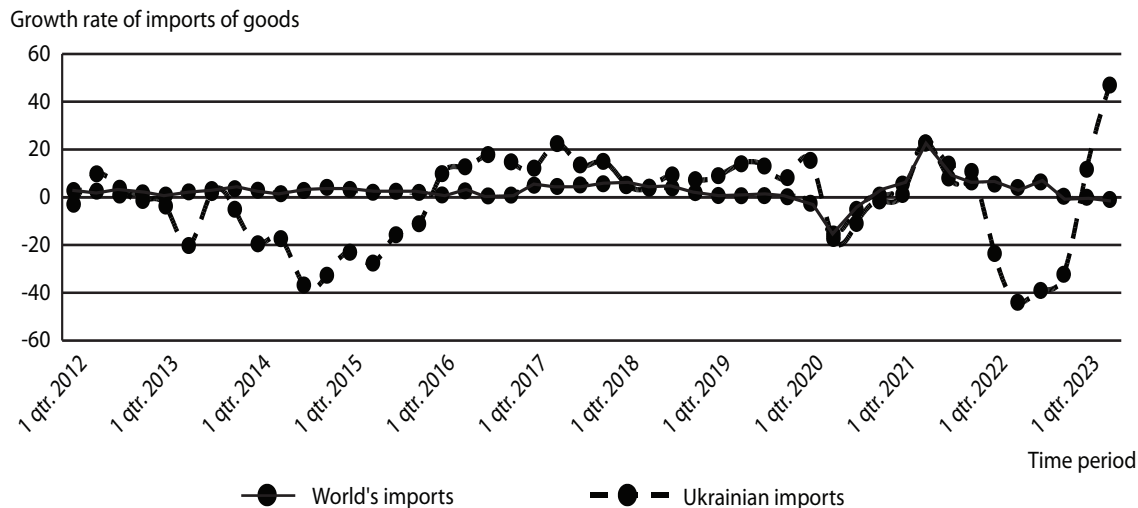


Fig. 2. Changes in the growth rate of imports of goods

Source: compiled from data of [12]

ing the efficiency of export-import activities of the world leading countries.

According to the World Trade Organization (WTO) [14], in 2022, the top ten exporting and importing countries were

one North American country – the United States of America; several European countries – Germany, the Netherlands, Italy, Belgium, France, and such Asian countries as Japan, the Republic of Korea, and China, including Hong Kong (Fig. 3).

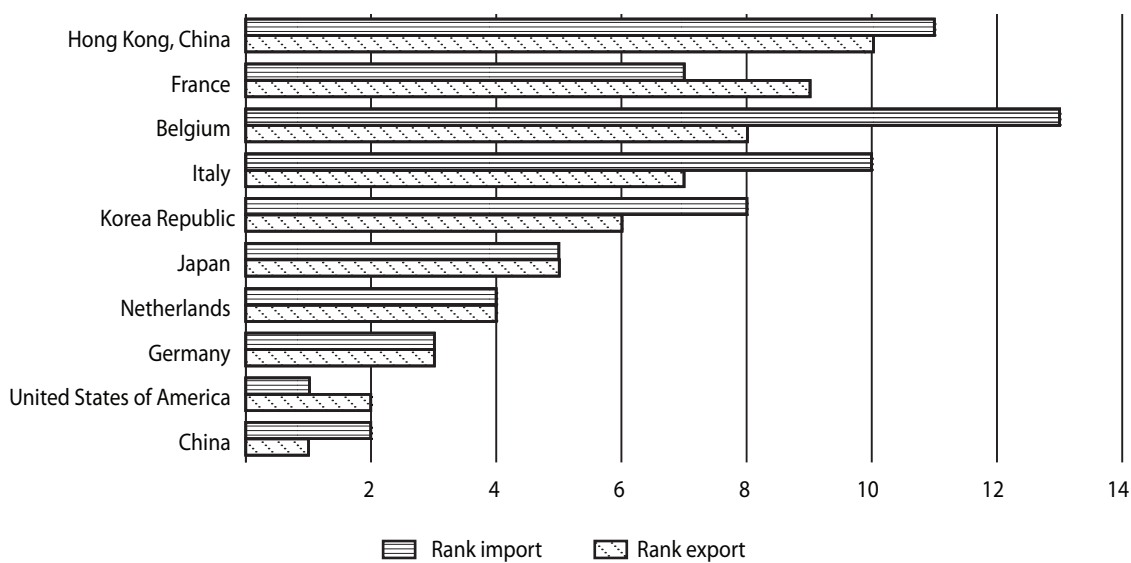


Fig. 3. A ranking of world leaders in exports and imports for 2022

Source: compiled from data of [14]

Each of these groups of countries has its own unique characteristics and impact on the global economy. The United States of America is a key player in North America, Asian countries (China, Japan, South Korea) are known for their high-tech industries and significant influence on world trade, Hong Kong is an important financial center of Asia, the leading European countries in terms of exports and imports are members of the European Union (EU) and participants in the joint economic and political cooperation that was established by the creation of the EU. As stated in [13, p. 7]: «E-commerce and postal services (part of Section 3 of the EU acquis) is the most rapidly developing area of trade in the world in recent years. The Eu-

ropean Union is the closest geographically and one of the most solvent destinations for Ukrainian e-commerce». Since one of Ukraine's key ambitions is to introduce and comply with EU standards and practices, it is advisable to find out the main areas in which Ukraine can improve its level of foreign trade, approaching the level of the leading European countries. Indeed, ICT is an important practical aspect for all European countries, the use of modern digital payment systems largely facilitates financial transactions between European exporters and importers. Still, there are a number of characteristics that distinguish the European export/import leading countries from other European countries.

Germany is characterized by a high level of industrial development with a focus on technological and high-tech sectors (Industry 4.0), the use of electronic systems to automate customs procedures and track export-import operations is widespread. In 2022, across different sectors of the economy in Germany, an average of 73% of large enterprises (with 250 or more employees), 54% of enterprises with 50 to 249 em-

ployees, and 29% with 10 to 49 employees used ICT and performed internal and external IT tasks (more than 10 requests) (Fig. 4).

Among the most active sectors of the economy are the processing and construction industries, the services, the sectors of real estate and housing, and the trade and maintenance of motor vehicles.

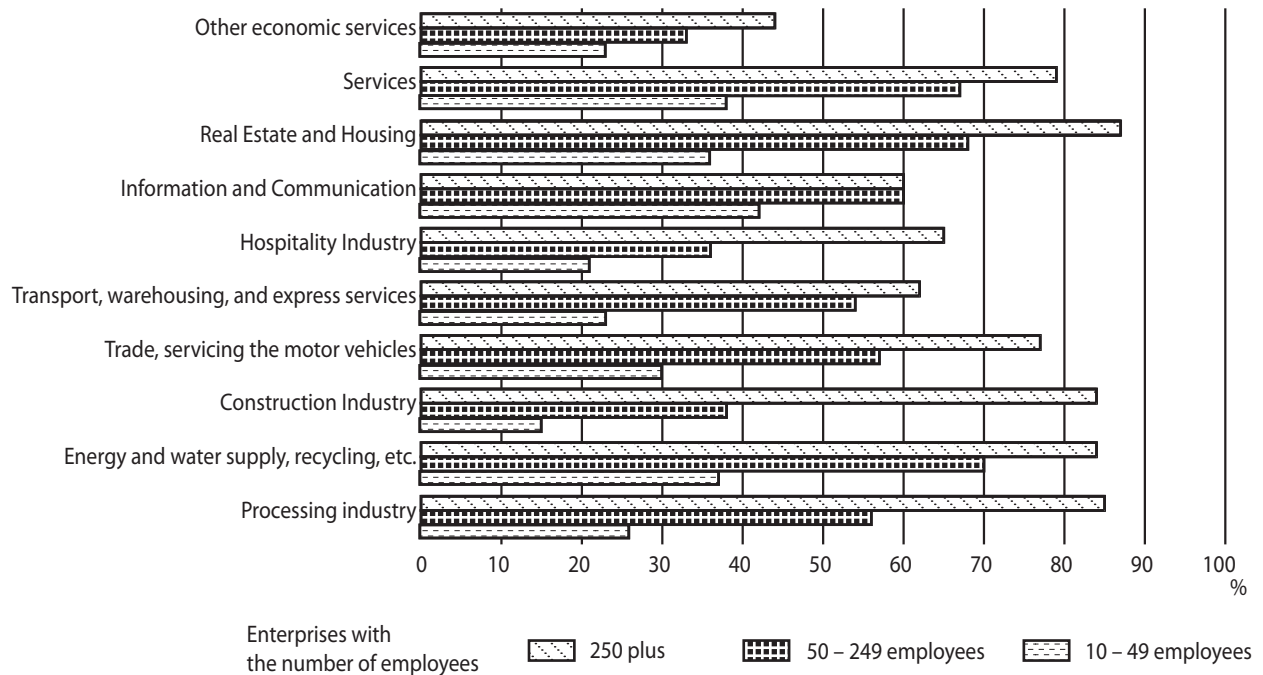


Fig. 4. ICT use by sector of the German economy in 2022

Source: compiled from data of [15]

Attention should also be paid to the active use of Internet of Things (IoT) technologies in Germany to create an «Intelligent Factory», where industrial enterprises automate and optimize production processes with the help of sensors and connected devices. Among the most influential German exporting companies, the well-known automaker Volkswagen Group and the technology company Siemens AG, succeeding in exports of high-tech products and services, are active users of Internet of Things technologies.

The next European export/import leader, the Netherlands, plays the role of Europe’s transport hub, thanks to a large number of seaports and a developed network of roads and railways. The country’s business has close ties with information technology services, the trade turnover indices of the ICT sectors of the economy are increasing every year (Fig. 5), while it is the information activity that is ahead of other sectors related to ICT in terms of turnover indices. For 2018 – 2021, the intensity of R&D expenditures in all sectors of the economy averaged 2.27% of GDP, including 1.5% of GDP in the sphere of business [17], contributing to the development of export-import operations and the country’s economy as a whole.

According to CBS StatLine [18], the value added due to the Netherlands’ Exports increased from € 252.3 billion billion in 2020 up to € 336.6 billion in 2022. This country has a strong focus on the transport and logistics industries, e-commerce

and the financial sector. IoT technology in the Netherlands is actively used in the agricultural sector, monitoring and management systems allow farmers to use resources more efficiently. According to the Global Innovation Index 2022 report of the World Intellectual Property Organization, the Netherlands ranks fifth [19]. Royal Dutch Shell, one of the world’s largest oil and gas companies, and Unilever, which specializes in the production of consumer goods, have a significant impact on the increase in the Netherlands’ exports/imports.

As for France, in 2022, imports accounted for 37.6% of domestic demand, and exports accounted for 34.7% of GDP [12]. France is developing electronic systems for tendering, thus facilitating the efficient exchange of information, and integrating ICT into logistics to track and control cargoes and improve the efficiency of deliveries. In 2021, 58% of employees in EU companies used the Internet (63% in France) and the share of companies running a website was 78% (71% in France). Small and medium-sized companies in France are less likely to have a website (67%, compared to 75% in the EU) and 94% of very large companies in France, as in Europe, have their own websites [20]. Owning a website allows businesses to use digital channels to promote their products and services in the global market, strengthens their interaction with potential and existing commercial partners. Innovative enterprises in France are implementing the concept of Industry 4.0, using IoT to auto-

Trade turnover indices by sectors of the economy

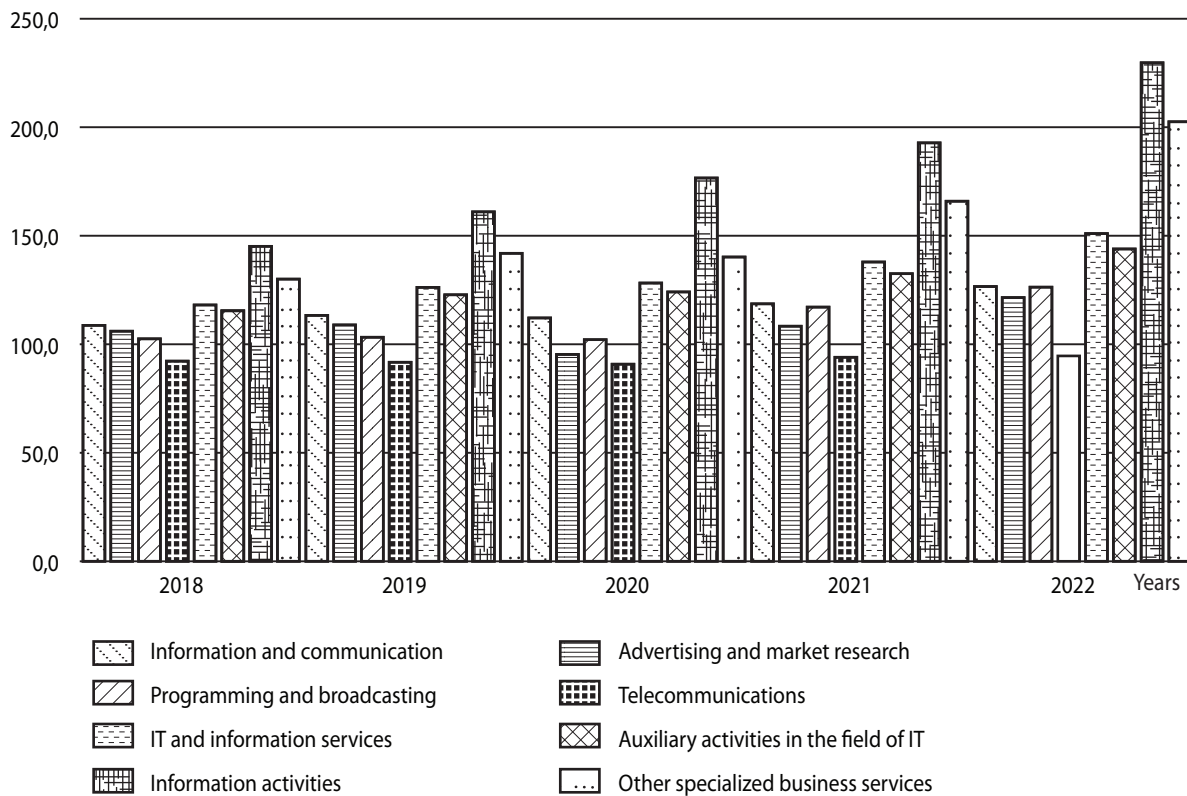


Fig. 5. Changes in trade turnover indices by sectors of the economy of the Netherlands (compared to 2015)

Source: compiled from data of [16]

mate and optimize production processes, that allows to increase productivity and reduce costs.

Belgium ranks fourth among the European countries leading in exports/imports. This country is mostly focused on the export of chemical and pharmaceutical products and also actively uses ICT (Fig. 6).

Belgium actively uses IoT in transport and logistics to track and manage the movement of goods. Truck and cargo

sensors can improve transport efficiency and reduce delivery times. In 2021, 23.2% of businesses in Belgium faced a problem at least once due to an ICT security incident: unavailability of ICT services, destruction or damage of data, disclosure of confidential data. This was determined as a result of a survey on the use of ICT and e-commerce in enterprises, conducted by the Belgian statistical office Statbel between May and September 2022 [22]. Protecting the information and network of

Use of computer equipment

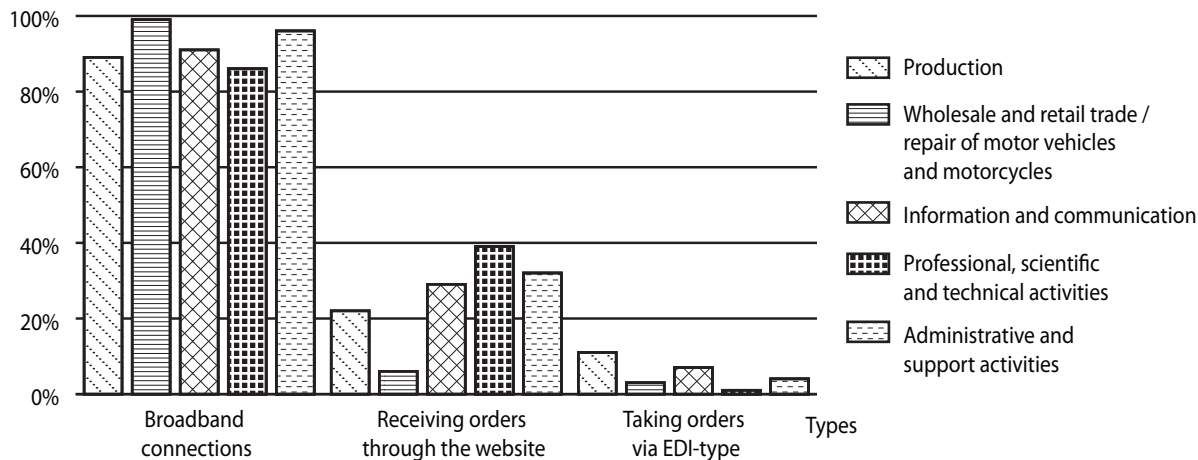


Fig. 6. Use of computer equipment by enterprises in Belgium by sectors of the economy

Source: compiled from data of [21]

enterprises from cyber threats is critical to ensuring security in foreign trade operations. To prevent security issues, 39.4% of businesses in Belgium use at least two authentication mechanisms, and 12.6% use authentication using biometric methods, 77.2% of enterprises use network access control (management of user rights in the enterprise network), 33.1% of enterprises have insurance against ICT security incidents [22].

Italy is also focused on high-tech industrial sectors and is actively developing digital technologies and robotics in manufacturing and small businesses, which provides support for its foreign economic activity (Fig. 7).

Italy, where the level of ICT use is increasing every year, is marked by the fact that ICTs are becoming a key factor that fosters the development of export-import activities in various sectors of the economy. Digitalization in production helps to increase efficiency, reduce costs and respond quickly to changes in global market conditions, and that in turn improves the competitiveness of Italian products in the international market. Italian companies in the sphere of technology and information services are actively using ICT to create and deliver innovative solutions. This helps them provide quality IT services and products to customers around the world and leads to increased

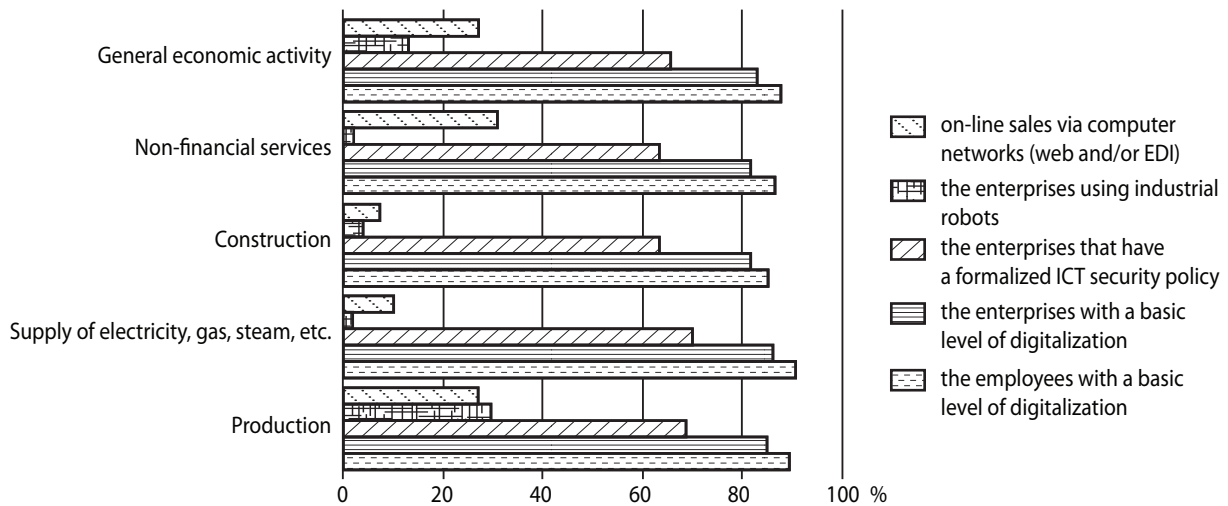


Fig. 7. Use of ICTs by sectors of the Italian economy in 2022

Source: compiled from data of [23]

export flows. In agriculture, Italy uses IoT to measure humidity, temperature, light intensity, and other parameters, allowing farmers to manage crop cultivation and increase crop yields more efficiently. In finance and banking, Italy also uses ICT to ensure the efficiency and security of international financial transactions. Digital technologies make it possible to carry out fast and secure global financial transactions.

Ergo, the development of foreign trade of European leaders requires the active use of ICT, and this turns out to be a necessary and important aspect of their success in the further development of export-import activities. A generalization and analysis of the main features of the introduction of ICT in these countries made it possible to determine the main directions of the use of ICT in external activities (Tbl. 1).

Ukraine can apply such practices of European leaders and become a powerful participant in global digital initiatives. The effective use of ICT will become a strategic reserve for restoring and maintaining the country's competitiveness in the international arena in the post-war period and will contribute to growth in global economic conditions in the future.

An important issue in the study of the development of export-import activities based on ICT is the assessment and modeling of the impact of ICT on the volumes of foreign trade. In the paper [4], an analysis of various economic and mathematical models for assessing the impact of ICT on the economic development of countries in general, specific enterprises,

and the ICT sector is carried out. It is noted that «the very fact that such mathematical modeling is performed and developed testifies to the awareness of the importance of modern digital technologies for economic development» [4, p. 94].

In this study, it is proposed to examine the relationship between export/import volumes (y_1 / y_2), € million (based on the data referred as [24]) and the main components of the Digital Economy and Society Index of the EU countries for 2022. The Digital Economy and Society Index combines the relevant indicators of Europe's digital performance and tracks the development of the EU Member States according to four main components: human capital, communications, digital technology integration, and digital public services [25]. Each of these components, in turn, is divided into separate sub-components, which are characterized by separate indicators. According to the data [25], to analyze the impact of ICT on the development of export-import activities, the indicators were selected that are appropriate for logical reasons in the context of this study, namely: persons with basic digital skills (x_1), % of persons aged 16–74 years; individuals with digital skills above basic (x_2), % of persons aged 16–74 years; individuals with a basic level of skills in using digital content creation software (x_3), % of people aged 16–74 years; ICT salaried specialists (x_4), % of total employment; enterprises providing ICT training (x_5), %; settlements with coverage of at least one 5G mobile network (x_6), %; enterprises with a basic level of digital intensity (use of

Practical aspects of the use of ICT in external activities

ICT Implementation Direction	Description
Digital infrastructure: electronic documentation, electronic information exchange	Significant investments in the development of high-performance infrastructure, the use of electronic systems for the exchange of documentation and information between participants in foreign trade, the introduction of electronic systems to simplify customs procedures and logistics operations ensure fast and reliable communication between business and counter parties
e-commerce	The use of advanced technologies for online sales, the use of electronic trading platforms contributes to the optimization of own business processes, the expansion of the global audience of potential consumers and the increase in the availability of goods and services
Digital innovation in manufacturing	The introduction of the technology of Internet of Things, artificial intelligence, and robotics makes products competitive in the global market
Digital finance	The use of the instrumentarium of digitalization of financial solutions (development of electronic payment and electronic banking systems) simplifies the conduct of international financial operations and transactions
Digital marketing and promotion	Using digital channels to promote export and other products in the international market, developing online marketing strategies to expand the niche of the global market, applying data analytics to identify and forecast market demand, using the Internet to find new partners, customers and markets
Digital logistics	The use of modern GPS systems and IoT technologies allows to efficiently send and receive goods, reducing the time and cost of transportation
Cybersecurity	Ensuring the security of electronic trading platforms and payment systems, that guarantees the protection of confidentiality and integrity of information and network infrastructure

Source: own analysis

at least 4 technologies) (x_7), %; enterprises that use electronic information exchange (x_8), %; businesses that use two or more social media (x_9), %; enterprises that analyze big data from any data source (x_{10}), %; enterprises that purchase at least one of the cloud computing services (x_{11}), %; enterprises that use any artificial intelligence technology (x_{12}), %; turnover from e-commerce (x_{13}), % of total turnover; cross-border online sales (x_{14}), %; digital public services for business, (x_{15}), scores from 0 to 100.

Since the EU countries differ significantly in terms of foreign trade, the totality of countries was divided into two groups: the first group consists of countries whose export and import volumes exceed € 100.000 million; the second group consists of countries with export and import volumes of up to € 100.000 million. The first group includes the leading export/import countries and most of the countries of Eastern Europe, that have undergone or continue to undergo transformations similar to those in Ukraine after the collapse of communist regimes.

According to the values of correlations between the performance indicators (y_1 та y_2) and the indicators of the subcomponents of the index of the digital economy and society, it was found out:

- y_1 for the first group of countries, is most related to the indicators x_6, x_8, x_{10} (positive correlation); for the second group – with the indicator x_{12} (positive correlation), and with indicators x_{14}, x_{15} (negative correlation),
- y_2 for the first group of countries is most related to the indicators x_6, x_8, x_9, x_{10} (positive correlation); for

the second group of countries – with the indicators x_6, x_{12} (positive correlation), and with indicator x_{15} (negative correlation).

At the same time, the selected independent variables of the model do not correlate with each other (correlation at the level of 0.1 – 0.2), that indicates the absence of multicollinearity and the feasibility of their use in linear regression models. During the simulation, the significance of the coefficients of regression models by the Student's t-test was checked. It was found that some coefficients turned out to be insignificant and the corresponding indicators were removed from the models.

The following models were obtained:

- for the first group of countries $y_1 = 171478,22 + 4802,52 x_6, R^2 = 0,61; y_2 = 146942,06 + 5152,51 x_6, R^2 = 0,63;$
- for the second group of countries $y_1 = 113078,37 + 2795,05 x_{12} - 1135,24 x_{15}, R^2 = 0,46; y_2 = 100153,33 + 352,39 x_6 + 2516,19 x_{12} - 1026,32 x_{15}, R^2 = 0,55.$

According to these models, it can be determined that for the countries whose export and import volumes do not exceed € 100.000 million, exports are positively affected by the use of artificial intelligence technology, while e-commerce is inefficient, that leads to a decrease in export volumes; imports are positively affected by 5G network coverage and the use of artificial intelligence technology, and e-commerce also leads to a decrease in imports. That means, owing to the active use of artificial intelligence technology, foreign economic strategies in these countries are being adapted and conditions for the formation of their competitiveness are created. However, small values of the coefficient of determination indicate that these models

need to be further improved by including other factors that will define what exactly prevents these countries from increasing exports and imports. Of course, the dominance of certain technological modes in these countries differs significantly from the countries of another group, thus determining the corresponding effect of digitalization.

For the countries of the first group, the volume of exports and imports of which exceeds € 100.000 million, is found that only one factor is of significant importance in the context of the development of foreign trade – the coverage of the 5G network. The indicator of determination of the built models for the countries of this group is also small and determines that 5G technology explains the variation in exports and imports by about 60%, and 40% is the effect of unaccounted factors that are not related to ICT. Since the analysis was carried out only on the basis of data from one year, such results can be explained by the fact that by 2022 the countries of the first group already had a strong developed information and communication infrastructure (almost all indicators of the digital economy and society index are ahead) and continued to direct their efforts towards achieving a higher level of ICT development. The introduction of 5G technology today is an urgent and strategic direction for the development of these countries, and the use of 5G in foreign trade builds a new space for innovation and creates new business opportunities.

So, it is proved that the development of export-import activities requires intensification of the development and implementation of ICT. The use of ICT in modern foreign trade ensures the efficiency and flexibility of export-import operations. ICTs are becoming an integral part of the global trade space and ensure the transition from a traditional to an innovative approach in international trade.

Conclusions. Thus, in the modern global space, it is important for the development of export-import activities to use ICT, which is a stimulator of innovation in foreign trade. Countries that actively integrated ICTs into their trade operations have become leaders in international cooperation. The analysis of the features of the use of ICT in the export-import activities of the world's and European countries-leaders in foreign trade allowed to identify the main directions of ICT implementation, which should become a guideline for the recovery and development of export-import activities of Ukraine.

The results of the study indicate the positive impact of ICT on the increase in exports and imports. Modeling the relationship between the volume of exports and imports and the indicators of the digital economy index confirms that countries with a higher level of digital readiness tend to develop foreign trade relations sustainably.

Further direction of development of this research is envisaged in the study of models of dynamics and the inclusion of additional factors influencing foreign trade, namely human potential, financial and material support for the introduction of ICT, based on the experience of leading European countries.

LITERATURE

1. L'essentiel sur... la mondialisation. URL: <https://www.insee.fr/fr/statistiques/3633242>
2. Шемаєва Л. Г., Шемаєв В. В., Франчук В. І. та ін. Оцінка впливу інформаційно-комунікаційних технологій на показники зовнішньоторговельної безпеки держави. *Фінансово-кредитна діяльність: проблеми теорії та практики*. 2019. № 3 (30). С. 414–442. URL: <https://ep3.nuwm.edu.ua/15902/>
3. Кульганік О. М. Сучасні процеси міжнародної торгівлі України в умовах глобалізації. *Ефективна економіка*. 2019. № 10. DOI: 10.32702/2307-2105-2019.10.71
4. Вишневецький В. П., Гаркушенко О. М., Князев С. І., Липницький Д. В., Чекіна В. Д. Цифровізація економіки України: трансформаційний потенціал : монографія / за ред. В. П. Вишневецького, С. І. Князева; НАН України, Інститут економіки промисловості. Київ : Академперіодика, 2020. 188 с.
5. Zhang X., Wang Y. Research on the Influence of Digital Technology and Policy Restrictions on the Development of Digital Service Trade. *Sustainability*. 2022. No. 14. 10420. DOI: 10.3390/su141610420
6. Yi Z., Wei L., Huang X. Does Information-and-Communication-Technology Market Openness Promote Digital Service Exports? *Sustainability*. 2022. No. 14. 4901. DOI: 10.3390/su14094901
7. Wagner J. Website Premia for Extensive Margins of International Firm Activities: Evidence for SMEs from 34 Countries. *Economies*. 2022. No. 10. 250. DOI: 10.3390/economies10100250
8. Малярєць Л. М., Отенко В. І., Отенко І. П. та ін. Моніторинг експортно-імпортного потенціалу та ефективності його використання : монографія. Харків : ХНЕУ ім. С. Кузнеця, 2022. 171 с.
9. Станіславик О., Коваленко О. Проблемні аспекти управління ефективністю експортної діяльності вітчизняних підприємств в умовах військового стану. *Економіка. Фінанси. Право*. 2023. № 3. С. 16–21. DOI: 10.37634/efp.2023.3.4
10. Li B., Li L., Li R., Yue Y. Internet and firms' exports and imports: Firm level evidence from China. *The World Economy*. 2022. No. 00. P. 1–38. DOI: 10.1111/twec.13310
11. Бушовська Л. Б., Поплавська О. В., Ядуча С. Й. Формування механізму управління експортно-імпортними операціями в системі забезпечення економічної безпеки підприємств. *Innovation and Sustainability*. 2022. № 4. С. 119–128. DOI: 10.31649/ins.2022.4.119.128
12. Volume growth rates of merchandise exports and imports, quarterly. URL: <https://unctadstat.unctad.org/datacenter/dataviewer/US.MerchVolumeQuarterly>
13. Інтеграція України до внутрішнього ринку ЄС в умовах війни: виклики та можливості. URL: <https://www.kas.de/documents/270026/22934445/UA+2023+UCER+Ukraine%27s+integration+into+the+EU+internal+market+in+the+condition+of+war+challenges+and+opportunities+.pdf/ca22c1d7-45ee-3e2c-d874-bd8dfb1a1710?version=1.0&t=1686055086884>
14. Statistical tables. URL: https://www.wto.org/english/res_e/booksp_e/wtsr_2023_ch5_e.pdf
15. IKT-Indikatoren für Unternehmen: Deutschland, Jahre, Wirtschaftszweige, Beschäftigtengrößklassen. URL: <https://www-genesis.destatis.de/genesis/online?operation=abruftabelle&levelindex=0&levelid=1699814236806&auswahloperation=abruftabelleAuspraegungAuswaehlen&auswahlverzeichnis=ordnungsstruktur&auswahlziel=werteabruf&code=52911-0004&auswahltext=&werteabruf=Werteabruf#breadcrumb>
16. Business and ICT services. URL: <https://opendata.cbs.nl/statline/#/CBS/en/dataset/83854ENG/table?ts=1700127840868>
17. Research and development. URL: <https://opendata.cbs.nl/statline/#/CBS/en/dataset/83854ENG/table?ts=1700127840868>

nl/statline/#/CBS/en/dataset/84644ENG/table?ts=1700134593297

18. Earnings and labour volume; export flows. URL: <https://opendata.cbs.nl/statline/#/CBS/en/dataset/85256ENG/table?ts=170013096518>

19. BOIB: оприлюднено глобальний інноваційний індекс 2022 року. URL: <https://ukrpatent.org/uk/news/main/wipo-global-innovation-index-2022-29092022>

20. TIC dans les entreprises en Europe. URL: <https://www.insee.fr/fr/statistiques/6667021?sommaire=6667157>

21. Survey on the enterprise's informatical equipment by year, region, sizeclass and activity sector. URL: <https://bestat.statbel.fgov.be/bestat/crosstable.xhtml?view=277d6f32-2b8f-491f-a3fb-836d76d05433>

22. ICT and e-commerce in enterprises. URL: <https://statbel.fgov.be/en/themes/enterprises/ict-and-e-commerce-enterprises#news>

23. ICT in companies with at least 10 persons employed. URL: <http://dati.istat.it/Index.aspx?QueryId=25003&lang=en>

24. Foreign trade. URL: <https://www.destatis.de/Europa/EN/Topic/Key-Indicators/ForeignTrade.html>

25. Shaping Europe's digital future. URL: https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi-2022/charts/desi-composite?indicator=desi_sliders&breakdownGroup=desi&period=2022&unit=pc_desi_sliders

REFERENCES

"Business and ICT services". <https://opendata.cbs.nl/statline/#/CBS/en/dataset/83854ENG/table?ts=1700127840868>

Bushovska, L. B., Poplavska, O. V., and Yadukha, S. I. "Formuvannya mekhanizmu upravlinnia eksportno-importnyimi operatsiyami v systemi zabezpechennia ekonomichnoi bezpeky pidpriemstv" [Formation of a Mechanism for Managing Export-import Operations in the System of Ensuring the Economic Security of Enterprises]. *Innovation and Sustainability*, no. 4 (2022): 119-128.

DOI: 10.31649/ins.2022.4.119.128

"Earnings and labour volume; export flows". <https://opendata.cbs.nl/statline/#/CBS/en/dataset/85256ENG/table?ts=170013096518>

"Foreign trade". <https://www.destatis.de/Europa/EN/Topic/Key-Indicators/ForeignTrade.html>

"ICT and e-commerce in enterprises". <https://statbel.fgov.be/en/themes/enterprises/ict-and-e-commerce-enterprises#news>

"ICT in companies with at least 10 persons employed". <http://dati.istat.it/Index.aspx?QueryId=25003&lang=en>

"IKT-Indikatoren für Unternehmen: Deutschland, Jahre, Wirtschaftszweige, Beschäftigtengrossenklassen". <https://www.genesis.destatis.de/genesis/online?operation=abruftabelle&levelindex=0&levelid=1699814236806&auswahloperation=abruftabelle&auspraegung=auswaehlen&auswahlverzeichnis=ordnungsstruktur&auswahlziel=werteabruf&code=52911-0004&auswahltext=&werteabruf=Werteabruf#vbreadcrumb>

"Intehratsiia Ukrainy do vnurishnyoho rynku YeS v umovakh viiny: vyklyky ta mozhlyvosti" [Ukraine's Integration into the EU Internal Market in Wartime Conditions: Challenges and Opportunities]. <https://www.kas.de/documents/270026/22934445/UA+2023+UCEP+Ukraine%27s+integration+into+the+EU+internal+market+in+the+condition+of+war+challenges+and+opportunities+.pdf/ca22c1d7-45ee-3e2c-d874-bd8dfb1a1710?version=1.0&ts=1686055086884>

Kulhanik, O. M. "Suchasni protsesy mizhnarodnoi torhivli

Ukrainy v umovakh hlobalizatsii" [Modern Processes of International Trade of Ukraine in the Conditions of Globalization]. *Efektivna ekonomika*, no. 10 (2019).

DOI: 10.32702/2307-2105-2019.10.71

"L'essentiel sur... la mondialisation". <https://www.insee.fr/fr/statistiques/3633242>

Li, B. et al. "Internet and firms' exports and imports: Firm level evidence from China". *The World Economy*, no. 00 (2022): 1-38.

DOI: 10.1111/twec.13310

Maliarets, L. M. et al. *Monitorynh eksportno-importnoho potentsialu ta efektyvnosti yoho vykorystannia* [Monitoring of the Export-import Potential and the Effectiveness of Its Use]. Kharkiv: KhNEU im. S. Kuznetsia, 2022.

"Research and development". <https://opendata.cbs.nl/statline/#/CBS/en/dataset/84644ENG/table?ts=1700134593297>

"Shaping Europe's digital future". https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi-2022/charts/desi-composite?indicator=desi_sliders&breakdownGroup=desi&period=2022&unit=pc_desi_sliders

"Statistical tables". https://www.wto.org/english/res_e/booksp_e/wtsr_2023_ch5_e.pdf

"Survey on the enterprise's informatical equipment by year, region, sizeclass and activity sector". <https://bestat.statbel.fgov.be/bestat/crosstable.xhtml?view=277d6f32-2b8f-491f-a3fb-836d76d05433>

Shemaieva, L. H. et al. "Otsinka vplyvu informatsiino-komunikatsiinykh tekhnolohii na pokaznyky zovnishnyotorhovelnoi bezpeky derzhavy" [Assessment of the Influence of Information and Communication Technologies on Indicators of Foreign Trade Security of the State]. *Finansovo-kredytna diialnist: problemy teorii ta praktyky*. 2019. <https://ep3.nuwm.edu.ua/15902/>

Stanislavskiy, O., and Kovalenko, O. "Problemni aspekty upravlinnia efektyvnosti eksportnoi diialnosti vitchyznianskykh pidpriemstv v umovakh viiskovoho stanu" [Problematic Aspects of Managing the Efficiency of Export Activities of Domestic Enterprises in the Conditions of Martial Law]. *Ekonomika. Finansy. Pravo*, no. 3 (2023): 16-21.

DOI: 10.37634/efp.2023.3.4

"TIC dans les entreprises en Europe". <https://www.insee.fr/fr/statistiques/6667021?sommaire=6667157>

"VOIV: opryliudneno hlobalnyi innovatsiinyi indeks 2022 roku" [WIPO: Global Innovation Index 2022 Released]. <https://ukrpatent.org/uk/news/main/wipo-global-innovation-index-2022-29092022>

"Volume growth rates of merchandise exports and imports, quarterly". <https://unctadstat.unctad.org/datacentre/dataviewer/US.MerchVolumeQuarterly>

Vyshnevskiy, V. P. et al. *Tsyfrovizatsiia ekonomiky Ukrainy: transformatsiinyi potentsial* [Digitization of the Economy of Ukraine: Transformational Potential]. Kyiv: Akadempriodyka, 2020.

Wagner, J. "Website Premia for Extensive Margins of International Firm Activities: Evidence for SMEs from 34 Countries". *Economies*, no. 10. 250 (2022).

DOI: 10.3390/economies10100250

Yi, Z., Wei, L., and Huang, X. "Does Information-and-Communication-Technology Market Openness Promote Digital Service Exports?" *Sustainability*, no. 14. 4901 (2022).

Zhang, X., and Wang, Y. "Research on the Influence of Digital Technology and Policy Restrictions on the Development of Digital Service Trade". *Sustainability*, no. 14. 10420 (2022).

DOI: 10.3390/su141610420

Стаття надійшла до редакції 15.11.2023 р.

Статтю прийнято до публікації 05.12.2023 р.