2. СВІТОВЕ ГОСПОДАРСТВО І МІЖНАРОДНІ ЕКОНОМІЧНІ ВІДНОСИНИ

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FOREIGN TRADE OF HIGH-TECH GOODS AS THE ELEMENT OF NATIONAL INNOVATION SYSTEM DEVELOPMENT IN UKRAINE

The article is to describe the state of national innovation system of Ukraine using the data of foreign trade of high-tech goods. The research introduces the new way to classify high-tech goods in Ukraine according to international standards. The high-tech goods codes of Ukrainian Classifier of Goods for Foreign Economic Activity are brought into line (up to six digits) with the international classification of high-tech goods. The new classification of high-tech goods helps to provide correct analysis of export-import balance of Ukraine and make a correct data comparison with other countries. The methods of grouping, comparison, structural analysis, statistical analysis are used in this research.

Key words: *high-tech goods, international trade, export, import, innovations, national innovation system, Ukrainian Classifier of Goods for Foreign Economic Activity, codes of foreign economic activity, Organization for Economic Co-operation and Development.*

Introduction. The competitiveness of modern goods at international markets depends on unique innovative and creative production. Innovative production solves specific tasks at low cost and creates mass consumption of high-tech products. As the result, one of the important tasks of the Ukrainian government is creation of national innovation system that will stimulate its agents to develop, distribute and implement new technologies both inside and outside the country's borders.

Recent studies have provided reasons why country should move from the raw material specialization to exporting high-tech goods and services based on it. These export items should be extremely demanded by consumers at international markets and generated by local innovative enterprises that cooperate inside and outside of county's national innovation system. Considering this fact, Ukrainian enterprises should use technological solutions in field of organization of goods production and solve the consumer problems by offering competitive innovative products of high demand such as e-books, waterproof touch screen monitors and tablets, Nano technological products or SaaS (Software as a Service) based on AI (Artificial Intelligence) etc. According to this statement, the analysis of foreign trade of high-tech goods according to offered alignment with European high-tech goods customs codes classifications will help to solve main problems of Ukrainian innovation system operation and its high-tech goods export potential.

Analysis of recent science researches. The main research of national innovation system efficiency was made by foreign and Ukrainian scientists: C. Freeman, B.-A. Lundwall, R. Nelson, L.I. Fedulova, N.M. Bunialk, O.S. Marchenko and others. The study of foreign trade of high-tech goods and countries' export potential was made by V.M. Begma, S.V. Golinei, O.M. Kiselyova T.M. Melnik, O.V. Zubko, O.O. Oleynikov, O.B. Salikhova, and others. However, the problem of the impact of high-tech goods foreign trade within the framework of national innovation system remains inadequate.

Presentation of the main material. Production and overseas sales of high-tech goods remains the significant role of a country. The export volume of high-tech goods increases the speed of country's economic growth and its competitiveness at international market. In order to increase Ukraine's export capacity Ukrainian government should follow the development strategy based on knowledge economy and built stable national innovation system. National innovation system is the complex of linkages between various agents of innovations like government and enterprises that produce technology [1–3].

The linkages between the main economic agents of national innovation system can be determined by three major factors: infrastructure and knowledge level that influence on development of the science and generation of new technology; interaction between companies and organizations and other institutions in education and training

field; support and promotion of science and technology by government [4]. As the result of technology support and commercialization, innovative enterprises produce high-tech goods which can be exported worldwide. However, analysis of the key indicator of NIS – export-import balance of high-tech goods can be made.

Organization for Economic Co-operation and Development (OECD) developed the SITC classifier which includes the classification of high-tech goods. According to SITC classifier the high-tech goods groups include aerospace products, computer and office equipment, electronics and telecommunications, pharmaceuticals, scientific instruments, electric machinery and equipment, chemical products, non-electrical machinery and equipment.

Ukrainian government has not registered an official list of high-tech goods yet [5]. As a consequence, the high-tech goods list needs to be created in accordance with codes of Ukrainian Classifier of Goods for Foreign Economic

Table 1

High-Tech Codes of Ukrainian Classifier of Goods for Foreign Economic Activity according to SITC Rev. 4

№	Code labels of High Technology Products List-SITC Rev. 4	High-Tech goods codes of Ukrainian Classifier of Goods for Foreign Economic Activity
1	**525** Radio-actives and associated materials	284410, 284420, 284430, 284450, 284440, 284510, 284590, 284610.
2	**541** Medicinal and pharmaceutical products, excluding 542	284690, 293621, 293622, 293623, 293624, 293625, 293626, 293627, 293628, 293629, 293690, 294110, 294120, 294130, 294140, 294150, 294190, 293911, 293919, 293920, 293930, 293941, 293942, 293943, 293944, 293949, 293951, 293959, 293961, 293962, 293963, 293969, 293991, 293999, 293721, 293722, 293723, 293729, 293711, 293712, 293719, 293750, 293740, 293790, 293810, 293890, 300120, 300190, 300210, 300220, 300230, 300290, 300510, 300590, 300620, 300630, 300610, 300640, 300650, 300660, 300670, 300691, 300692.
3	**542** Medicaments (incl. veterinary medicaments)	300310, 300320, 300410, 300420, 300331, 300339, 300431, 300432, 300439, 300340, 300440, 300390, 300450, 300490.
4	**716** Rotating electric plant & parts thereof, n. e. s.	850110, 850131, 850132, 850133, 850134, 850120, 850140, 850151, 850152, 850153, 850161, 850162, 850163, 850164, 850240, 850211, 850212, 850213, 850220, 850231, 850239, 850300.
5	**718** Other power generating machinery & parts, n. e. s.	841011, 841012, 841013, 841090, 840110, 840130, 840140, 841221, 841231, 841229, 841239, 841280, 841290.
6	**751** Office machines	846900, 847010, 847021, 847029, 847030, 847050, 847090, 847210, 847230, 844331, 844332, 844339, 844399, 847290.
7	**752** Automatic data processing machines, n. e. s.	847130, 847141, 847149, 847150, 847160, 847170, 847180, 847190.
8	**759** Parts, accessories for machines of groups 751, 752	847350, 847310, 847340, 847321, 847329, 847330.
9	**764** Telecommunication equipment, n. e. s. & parts, n. e. s.	851711, 851712, 851718, 851761, 851762, 851769, 851770, 851810, 851821, 851822, 851829, 851830, 851840, 851850, 852550, 852560, 852610, 852691, 852692, 852580, 851890, 852910, 852990, 852210, 852290.
10	**771** Electric power machinery, and parts thereof	850421, 850422, 850423, 850431, 850432, 850433, 850434, 850440, 850410, 850450, 850490.
11	**774** Electro-diagnostic appa for medical sciences, etc.	901811, 901812, 901813, 901814, 901819, 901820, 902212, 902213, 902214, 902219, 902221, 902229, 902230, 902290.
12	**776** Cathode valves & tubes	854011, 854012, 854020, 854040, 854050, 854060, 854071, 854072, 854079, 854081, 854089, 854091, 854099, 854110, 854121, 854129, 854130, 854140, 854150, 854231, 854232, 854233, 854239, 854160, 854190, 854290.
13	**792** Aircraft & associated equipment; spacecraft, etc.	880211, 880212, 880220, 880230, 880240, 880260, 880510, 880521, 880529, 880100, 880310, 880320, 880330, 880390.
14	**871** Optical instruments & apparatus, n. e. s.	900510, 900580, 900590, 901210, 901290, 901110, 901120, 901180, 901190, 901310, 901320, 901380, 901390.
15	**874** Measuring, analyzing & controlling apparatus, n. e. s.	901410, 901420, 901480, 901490, 901510, 901520, 901530, 901540, 901580, 901590, 901710, 901720, 901730, 901780, 901790, 903110, 903120, 903141, 903149, 903180, 903190, 902610, 902620, 902680, 902690, 902710, 902720, 902730, 902750, 902780, 902790, 901600, 902300, 902410, 902480, 902490, 902511, 902519, 902580, 902590, 903210, 903220, 903281, 903289, 903290, 903010, 903020, 903031, 903033, 903040, 903032, 903039, 903082, 903084, 903089, 903090, 903300.
16	**881** Photographic apparatus & equipment, n. e. s.	900610, 900630, 900640, 900651, 900652, 900653, 900659, 900661, 900669, 900691, 900699, 900711, 900719, 900720, 900791, 900792, 900820, 900810, 900830. 900840, 900890, 901010, 901050, 901060, 901090.
17	**891** Arms & ammunition Arms & ammunition	871000, 930111, 930119, 930120, 930190, 930700, 930200, 930621, 930629, 930630, 930690, 930310, 930320, 930330, 930390, 930400, 930510, 930529, 930591, 930599.

Source: composed by author based on sources [6; 7]

Activity and harmonized with High Technology Products List-SITC Rev. 4 [6]. Due to this statement the problem of correct value of exports of high-tech goods calculation accrues. As the result the comparison of value of high-tech goods export of Ukrainian innovation system with other values of high-tech goods of national innovation systems will be incorrect.

As the result we recommend to group high-tech goods codes of Ukrainian classifier of goods for foreign economic activity according to High Technology Products List-SITC Rev. 4 (table 1).

The seventeen groups of high-tech goods were took from the SITC Rev.4: radio-actives and associated materials; medicinal and pharmaceutical products; medicaments; rotating electric plant and parts thereof; other power generating machinery and parts; office machines; automatic data processing machines; parts, accessories for machines; telecommunication equipment; electric power machinery, and parts thereof; electro-diagnostic apparatus for medical sciences; cathode valves and tubes; aircraft and associated equipment, spacecraft; optical instruments and apparatus; measuring, analyzing and controlling apparatus; photographic apparatus and equipment; arms and ammunition. Customs codes of Ukrainian Classifier of Goods for Foreign Economic Activity were harmonized with Code labels of High Technology Products List-SITC Rev.4.

Based on these harmonized codes the analysis of export-import of high-tech goods of Ukraine was made in 2017 (table 2).

According to the data of the table 2, export of high-tech goods is lower than import of high-tech goods in 2017 year. The arms and ammunition goods data is excluded in this research due to confidential information and state secret.

In 2017 imports of high-tech goods valued 5 361 726,6 thousand USD and total exports of high-tech goods – 1 106 036,1 thousand USD. The total share of high-tech goods import is 10.6% and total share of high-tech goods exports is 2.6% in 2017 year.

The research shows that the most developed countries in the world has high export share of high-tech goods (table 3). High-tech exports share in USA kept on growing since 2013 to 2016 year and the value was equal 20%. In 2016 year high-tech export share of other countries was following: China – 25.2%, Germany – 16.9%, Republic of Korea – 26.6%, Romania – 8.5%. Developed countries and developing counties show the tendency of high exports share of high-tech goods than less developed countries.

The positive export-import balance on high-tech goods in 2017 year valued 120 702,3 thousand USD and includes only radio-actives and associated materials.

Ukraine exported high-tech goods valued at 1 106 036,1 thousand USD. The major high-tech goods exports in 2017 were telecommunication equipment – 0.74% of total goods export, medicaments – 0.4% of total goods exports and radio-actives and associated materials – 0.3% of total goods exports.

In 2017 Ukraine imported high-tech goods with a value of 5 361 726,6 thousand USD. In terms of value the top import items include medicaments (including veterinary

Table 2

Export-Import of High-Tech Goods of Ukraine according to SITC Rev.4 in 2017 year

Code SITC Rev. 4	Labels of High Technology Products List-SITC Rev. 4	Export		Import		Balance, thd. USD
		thd. USD	share, %	thd. USD	share, %	
525	Radio-actives and associated materials	130 164,1	0,30	9461,8	0,02	120 702,3
541	Medicinal and pharmaceutical products, excluding 542	22 127,5	0,05	397 708,9	0,80	-375 581,4
542	Medicaments (incl. veterinary medicaments)	172 672,1	0,40	1 439 113,0	2,90	-1 266 440,9
716	Rotating electric plant & parts thereof, n. e. s.	89 581,2	0,21	209 379,5	0,42	-119 798,3
718	Other power generating machinery & parts, n. e. s.	72 648,2	0,17	579 997,9	1,17	-507 349,7
751	Office machines	34 498,9	0,08	104 154,1	0,21	-69 655,2
752	Automatic data processing machines, n. e. s.	10 202,4	0,02	524 967,5	1,06	-514 765,1
759	Parts, accessories for machines of groups 751, 752	4 841,6	0,01	108 821,7	0,22	-103 980,1
764	Telecommunication equipment, n. e. s.; & parts, n. e. s.	318 343,3	0,74	1 146 200,0	2,31	-827 856,7
771	Electric power machinery, and parts thereof	94 716,2	0,22	153 849,0	0,31	-59 132,8
774	Electro-diagnostic appa for medical sciences, etc.	7 408,9	0,02	126 578,2	0,26	-119 169,3
776	Cathode valves & tubes	7 408,9	0,02	126 578,2	0,26	-119 169,3
792	Aircraft & associated equipment; spacecraft, etc.	28 208,5	0,07	28 453,8	0,06	-245,3
871	Optical instruments & apparatus, n. e. s.	12 012,9	0,03	126 280,1	0,25	-114 267,2
874	Measuring, analyzing & controlling apparatus, n. e. s.	100 209,4	0,23	277 054,5	0,56	-176 845,1
881	Photographic apparatus & equipment, n. e. s.	991,8	0,00	3 128,5	0,01	-2 136,7
891	Arms & ammunition					
	Total	1 106 036,1	2,6	5 361 726,6	10,8	-4 255 690,5

Source: composed by author based on sources [6; 7]

Table 3

High-tech goods export share in the world's goods export, %

Country	2013	2014	2015	2016
China	27.0	25.4	25.6	25.2
Germany	16.1	16.0	16.7	16.9
Republic of Korea	27.1	26.9	26.8	26.6
Romania	5.7	6.4	7.5	8.5
Ukraine	5.9	6.5	7.3	–
USA	17.8	18.2	19.0	20.0
World	17.0	17.1	18.5	17.9

Source: composed by author [8]

medicaments), telecommunication equipment and other power generating machinery.

According to our research (fig. 1), total export share of high-tech goods was at the level of 2.6% in 2017 year. The export share of high-tech goods has decreased from 3.3% to 2.6% for the period since 2013 to 2017 year in Ukraine.

Foreign trade share of high-tech goods is declined relative to total exports of high-tech goods in 2017. There is the tendency of foreign trade decrease during the period 2013 to 2017 year. This tendency is taking place due to political and economic situation, bankruptcy of local enterprises, liquidation of production capacities and trade barriers with Russia.

The export-import balance of high-tech goods was increasing till 2015 year. In 2016 to 2017 the value of the export-import balance was kept on decreasing till the -4 255 690.5 thousand USD. According to our research we make a conclusion that Ukraine is still dependent on imported high-tech goods even though the country has an access to local high-skilled professionals of technical majors.

The rating of the World Economic Forum show that Ukraine is on 34th place. The experts concluded that Ukraine's main advantage is well educated human capital. It is on 27th position in nomination "Quality of Mathematical and Fundamental Natural Resource Development". However, Ukraine's 29th position was represented by presence of scientists and engineers [9].

In developed countries there is a tendency of scientists' and engineers' wages growth. This fact depends on significant incensement of high-tech goods production and exports [10]. However, Ukraine shows the opposite trend and remains less developed county with national innovation system that need to be reorganized at the level of the government. The problem of government support of national innovation system of Ukraine still remains unsolved and as the result the linkages between Ukrainian innovation systems needs to be reformed.

Conclusions. In order to increase the high-tech exports in Ukraine and compete at global market, the government of Ukraine should create and support the national innovation system and it's linkages between innovation agents. The following research shows that the national innovation system of Ukraine requires government changes in order to be competitive at foreign markets and increase the growth of high-tech goods production. The following measures should be done: implementation of scientific technical programs, increase of financial support of local science and scientific institutions, improvement of regulatory policy of creation and diffusion of innovations, harmonize the data of high-tech statistics according to international standards, assistance in innovation and high-tech export promotion.

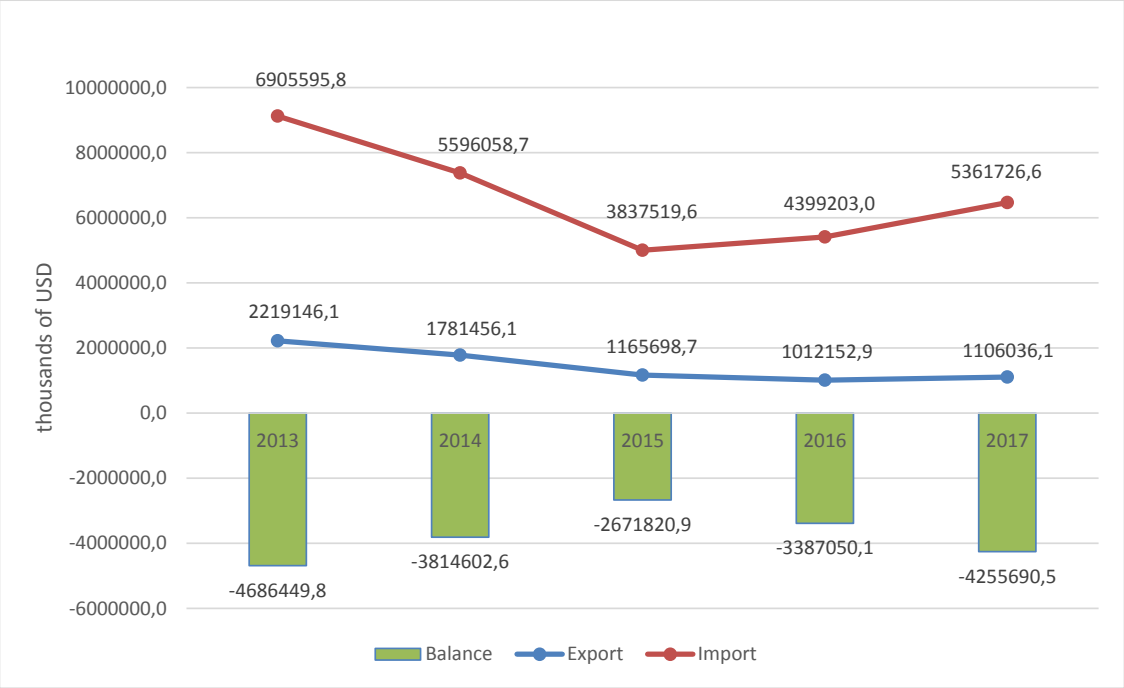

Fig. 1. Dynamics of foreign trade of high-tech goods of Ukraine in 2013–2017 year, thd. USD

Source: composed by author based on source [7]

References:

1. Freeman C. Technology Policy and Economic Performance: Lessons from Japan. London: Pinter, 1987.
2. Lundvall B. (ed.) National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. London: Frances Pinter, 1992.
3. Patel P., Pavitt K. The Nature and Economic Importance of National Innovation Systems. STI Review. 1994. № 14. P. 9–32.
4. Nelson R. National Innovation Systems. A Comparative Analysis. Nelson. USA: Oxford, 1993. P. 6–13.
5. Yaremchuk N.T. Grinko I.M. Analysis foreign trade by high-tech products of Ukraine. Naukovyi Visnyk of Uzhgorod national university. 2016. № 6. P. 171–174.
6. High Technology Products List-SITC Rev. 4. URL: https://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an5.pdf.
7. State statistical service of Ukraine. URL: http://www.ukrstat.gov.ua.
8. World Bank Open data. URL: https://data.worldbank.org.
9. World economic forum. URL: https://www.weforum.org.
10. Melnyk T.M., Zubko O.V. Foreign trade with high-tech commodities: institutional dimension. Marketing and Innovation Management. 2012. № 2. P. 181–190.

ЗОВНІШНЯ ТОРГІВЛЯ УКРАЇНИ ВИСОКОТЕХНОЛОГІЧНИМИ ТОВАРАМИ ЯК ЕЛЕМЕНТ РОЗВИТКУ НАЦІОНАЛЬНОЇ ІННОВАЦІЙНОЇ СИСТЕМИ

Стаття описує актуальний стан національної інноваційної системи України. Використовуючи статистичні дані зовнішньої торгівлі високотехнологічними товарами, автор пропонує новий спосіб класифікації високотехнологічних товарів в Україні відповідно до міжнародних стандартів. Сформовано перехідні таблиці високотехнологічних товарів згідно з міжнародною класифікацією високотехнологічних товарів. Запропонована класифікація високотехнологічних товарів дає змогу забезпечити правильний аналіз експортно-імпортного балансу України, зробити коректне порівняння даних з іншими країнами. У дослідженні використано методи групування, порівняння, а також структурний аналіз, статистичний аналіз.

Ключові слова: *високотехнологічні товари, міжнародна торгівля, експорт, імпорт, інновації, національна інноваційна система, УКТЗЕД, код УКТЗЕД, Організація економічного співробітництва та розвитку.*

ВНЕШНЯЯ ТОРГОВЛЯ УКРАИНЫ ВЫСОКОТЕХНОЛОГИЧНЫМИ ТОВАРАМИ КАК ЭЛЕМЕНТ РАЗВИТИЯ НАЦИОНАЛЬНОЙ ИННОВАЦИОННОЙ СИСТЕМЫ

Статья описывает актуальное состояние национальной инновационной системы Украины. Используя статистические данные внешней торговли высокотехнологичными товарами, автор предлагает новый способ классификации высокотехнологичных товаров в Украине в соответствии с международными стандартами. Сформированы переходные таблицы высокотехнологичных товаров согласно с международной классификацией высокотехнологичных товаров. Предложенная классификация высокотехнологичных товаров позволяет обеспечить правильный анализ экспортно-импортного баланса Украины, осуществить корректное сравнение данных с другими странами. В исследовании использованы методы группировки, сравнения, а также структурный анализ, статистический анализ.

Ключевые слова: *высокотехнологичные товары, международная торговля, экспорт, импорт, инновации, национальная инновационная система, УКТВЭД, код УКТВЭД, Организация экономического сотрудничества и развития.*