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STRATEGIC DIRECTIONS FOR INCREASING THE GROSS VALUE ADDED OF THE HIGH-TECH SECTOR (ON THE EXAMPLE OF THE UKRAINIAN ECONOMY)*

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Abstract. The article presents the results of research devoted to the development of conceptual and methodological bases for determining strategic directions for increasing the gross value added of the high-tech sector of the national economy, in particular, the modern role of high-tech and science-intensive sectors in economic development and the structure of the high-tech sector of the national economy are studied, the state of the high-tech sector of the Ukrainian economy and its gross value added are analysed, the types of economic activity of the high-tech sector are classified into strategic groups, strategic directions for increasing the gross value added of the high-tech sector of the Ukrainian economy are determined. The improved methodological approach to classifying the types of economic activity of the high-tech sector into strategic groups provides a differentiated approach to the development and reveals the sources of strategic directions for increasing gross value added. Value added and output were selected as classification criteria, taking into account the dynamics of development. Depending on the value added generated by a particular type of economic activity and its growth rate, all types of economic activity can be divided into four groups: strategic leaders, potential leaders, current leaders, and problem sectors. The proposed methodological approach helps to identify the risks from an inertial scenario, that is, the development of the situation by gravity without an appropriate policy, as well as to determine the strategic directions for implementing a progressive scenario. Systematic development of the high-tech sector is possible if the appropriate policy is formed on the basis of the national innovation system, the elements of which are: state regulation in the field of innovation; supply and demand of innovations; market infrastructure for innovations; human resources. According to these elements, the policy measures aimed at increasing the gross value added of economic activities of the high-tech sector, which have their own characteristics depending on the classification group, are systematized.

Keywords: gross value added; high-tech sector; strategic directions

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1. Introduction

The high-tech sector plays a crucial role in the socio-economic development of the world's states and is a key factor in their competitiveness. Ukraine is a state with a strong scientific and innovative potential, which is able to provide access to the world's leading positions. However, Ukraine lags significantly behind in the development of its high-tech sector from many other countries of the world, which requires the development of strategic measures to overcome the current situation. It is analysed the state of the high-tech sector of the Ukrainian economy and its gross value added, which allowed to determine the directions of development.

The methodological approach proposed in the article to determine the types of strategic approaches to the development of the high-tech sector of the national economy contributes to the development of differentiated measures for the types of economic activity of this sector, depending on what added value they generate and what importance they have in the total output, considering the dynamics of development.

In order to ensure the systematicity of measures to increase the gross value added of the high-tech sector, a comprehensive application of appropriate tools and mechanisms to all elements of the national innovation system is proposed.

The purpose of the research is to study the high-tech sector in context of gross value added and determine strategic directions for its increase.

Tasks:

- to analyse the state of the high-tech sector of the Ukrainian economy and its gross value added;
- to develop a classification of economic activities of the high-tech sector by strategic groups;
- to determine strategic directions for increasing the gross value added of the high-tech sector on the example of the Ukrainian economy.

Object of the research: strategic development of the high-tech sector of the national economy.

Subject: theoretical, methodological and applied bases for determining strategic directions for increasing the gross value added of the high-tech sector of the national economy.

The research puts forward the following **hypotheses**:

1. High-tech sector contributes to the country's economic development.
2. High-tech sector is developing dynamically in the world and in Ukraine.
3. Ukraine has the potential to develop a high-tech sector.
4. Determining the directions of increasing the gross value added of the high-tech sector requires classifying economic activities into strategic groups.
5. Systematic development of the high-tech sector is possible if the appropriate policy is formed based on the national innovation system.

The methodological tools of the research include:

- determination of the industry structure of the high-tech sector;
- parameters of gross value added of the high-tech sector;
- improvement of the methodological approach to the classification of economic activities by strategic groups;
- systematization in the context of: "strategic groups of economic activities – risks – strategic directions of the progressive scenario - measures".

International organizations, in particular the United Nations Industrial Development Organization (UNIDO), the Organization for Economic Cooperation and Development (OECD), the National Science Foundation, the World Economic Forum, Cornell University, INSEAD and WIPO, study high-tech sectors issues.

There were researched the studies of high-tech industries transformations on the basis of a value-added approach in different countries and analyzed their experience for Ukrainian realities, among other there are Central and Eastern Europe economies (Olczyk et. al. 2017, Rojicek 2007), OECD countries (Ceglowski 2015), EU countries (Parker 2000). It also were researched the value added chains within multinational high-tech corporations (Larsen et al. 2018). An important issue remains the interpretation of the factual material of international and national organizations and the countries' experience in the aspect of developing strategic directions for the development of the high-tech sector of the Ukrainian economy, which this research is devoted to.

The novelty of the obtained results is the developed methodological approach to the classification of economic activities of the high-tech sector by strategic groups (strategic leaders, potential leaders, current leaders and problem activities) depending on the generated added value and their output considering the development dynamics, that provides a differentiated approach and reveals the sources of strategic directions for increasing the gross value added. Systematic development of the high-tech sector is possible if the appropriate policy is formed based on the national innovation system, failures of this policy are considered as limitations of the research.

2. The current role of high-tech and science-intensive sectors in economic development

High-tech and science-intensive industries play a leading role in the development of the country's economy and social sphere. They materialize the main part of the results of scientific and technical (experimental) developments; they determine the demand for scientific achievements and create the basis for the supply of key technologies for all other sectors of the economy. The size of the high-tech sector and the scale of use of high technologies characterize the scientific, technical and economic potential of the country. The development of high-tech industries is crucial for the country's economic development. The transition to the production of high-tech products is accompanied by a decrease in the material and energy intensity of production, an increase in labour productivity and, consequently, an increase in the country's competitiveness. Today, it is indisputable that the high-tech production is the main factor in increasing employment and salaries.

The importance of high tech and science-intensive industries for the economic growth is determined by the following:

- at the enterprises of these industries more intensive innovation activities are carried out, which contributes to the expansion and creation of new sales markets and more efficient use of resources. The number of innovatively active industrial enterprises in high-tech sectors in Ukraine in 2019 was 34.8% of the total number of industrial enterprises, and the number of enterprises in these sectors that introduced innovations (products and/or technological processes) was 35% of the total number of industrial enterprises;
- a high share of value added in the volume of manufactured products contributes to the higher employment and remuneration of employees;
- the results of scientific and technical (experimental) developments implemented in high-tech and science-intensive sectors contribute to the accelerated development of other sectors of the economy;
- technological progress and innovation are a necessary prerequisite for the process of neoindustrialization, which, in turn, determines development. This idea is supported by Sustainable Development Goal No.9, which calls for "Creation of flexible infrastructure, promotion of inclusive and sustainable industrialization, and encouragement of innovations". Technology contributes to the achievement of goals in all three dimensions of sustainable development (economic, social and environmental). In particular, technology has an impact on reducing the consumption of non-renewable resources and the share of pollution per unit of production by improving energy efficiency, resource efficiency, pollution prevention and reduction, and waste recycling;
- global markets for high-tech goods and services are growing at a faster pace, which opens up new opportunities for domestic exports. In addition, new technologies create new markets, such as technologies for recycling and re-use of waste; bringing new and better products to the market (smart TVs, smart watches, home management devices, etc.);
- improvement of production efficiency through digitalization and interconnection of production processes.

The latest technological achievements form the next stage of progress – the Fourth Industrial Revolution. Its concept is based on the growing convergence of various new technological industries: digital manufacturing, nanotechnology, biotechnology and the development of new materials and their complementarity in manufacturing. Advanced digital manufacturing technologies are the result of a combination of three main components: hardware, software, and communication tools. The equipment includes tools and auxiliary systems of modern industrial robots and "smart" automated systems, as well as collaborative robots (robots that perform tasks together with humans) and 3D printers for additive manufacturing. This set of production equipment technologies is in many ways similar to the technologies of the previous stage – the Third Industrial Revolution. The distinctive features of the new machines are their means of communication, as well as flexibility and functionality in performing production tasks.

Advanced digital manufacturing technologies can increase a firm's profits and use of capital, better integrate labour into production, and improve environmental sustainability. The introduction of these technologies into industrial production requires additional support from other sectors of the economy, in particular, high-tech services that provide IT and digital solutions necessary for the implementation of "smart" production. Such interaction with services can potentially increase the multiplier effect of industrial production on job creation and poverty reduction, as well as open up new opportunities for countries to develop production (UNIDO 2019).

3. Structure of the high-tech sector of the national economy

It is important to note that the high-tech sector of the economy consists of the sphere of high-tech material production and the sphere of providing high-tech services. In the EU countries, the definition of high-tech industries is based on the criteria of R. Butchart, developed in 1987 (Butchart 1987). He followed a quantitative approach based on two main indicators: the level of R&D spending in sales and the share of scientists, engineers and technicians in the total number of employees in the industry. Later, this approach was first adapted to NACE Rev.1, then to NACE Rev.2 (OECD 2011). High-tech sector of the national economy according to the domestic classifier KVED-2010 (Classification of types of economic activity), considering the classification of NACE Rev.2 is shown in Table 1.

Table 1. Sectoral structure of the high-tech sector of Ukraine by type of economic activity (KVED-2010)

High-tech sector of the national economy			
KVED code	High-tech material production sphere	KVED code	Sphere of high-tech services provision
C20	Production of chemicals and chemical products	J58 – J60	Publishing activities; film, videos, TV shows production, sound recordings publications; radio and television broadcasting
C21	Production of pharmaceutical products	J61	Telecommunications (electrocommunication)
C26	Production of computers, electronic and optical products	J62 – J63	Computer programming, consulting and provision of information services
C27	Production of electrical equipment	M72	Research and development
C28	Production of machinery and equipment		
C29	Production of motor vehicles, trailers and semi-trailers		
C30	Production of other vehicles		
C32.5	Production of medical and dental instruments and materials		

Source: Prushkivska et. al. 2019

The analysis of the high-tech sector of the national economy in this research will be carried out in the context of gross value added. The statistical approach reflects the features of macroeconomic accounting for value added based on the system of national accounts. The international standard sectoral classification of all types of economic activity defines gross value added as the difference between the cost of output in basic prices and the cost of intermediate consumption (Peshina et.al. 2013). The term "gross" means that the added value includes the amount of consumption of fixed capital. The State Statistics Service of Ukraine describes gross value added as the difference between output and intermediate consumption; it includes primary income created by production participants and distributed among them. At the same time, the indicator of gross value added by type of economic activity is calculated as the amount of remuneration of employees, other taxes with the exception of other subsidies related to production, and gross profit (mixed income) (Nikishyna 2017).

4. Analysis of the state of the high-tech sector of the Ukrainian economy and its gross value added

The United Nations Industrial Development Organization (UNIDO) estimated that the top 10 economies account for 90% of all patents issued worldwide and 70% of all exports and 46% of digital technology-related imports. These countries include the United States, Japan, Germany, China, Taiwan, France, Switzerland, the United Kingdom, South Korea, and the Netherlands. Another 40 countries are classified as the followers who are actively working with these technologies, although much less intensively. In the rest of the world, there is very low activity (late economies) or a complete lack of participation in the global development and use of these technologies (lagging economies). Ukraine is classified as a country that is late, but participates in the production of digital technologies (UNIDO 2019).

Analysis of statistical data on the gross value added of the high-tech sector of the world economy and Ukraine in 2002-2018 showed the presence of the following trends:

- the growth of Ukraine's share in the global gross value added of the high-tech sector in 2018 compared to 2002 – 0.08 percentage points. However, in general, this share is insignificant – 0.15% in 2018;
- correspondence of the share of gross value added of the high-tech sector in GDP in Ukraine and in the world – 10.4% in 2018;
- the growth rate of gross value added of the high-tech sector of Ukraine is higher than the global indicator;
- analysis of GDP growth rates and gross value added of the high-tech sector in the world and in Ukraine (Figure 1, 2) showed that their dynamics coincide with a slight excess of the growth rate of gross value added of the high-tech sector. This is explained by the effect of delayed development of the high-tech sector in relation to traditional ones, associated with the time lag necessary for implementing results on a general economic scale (Peshina et al. 2013).

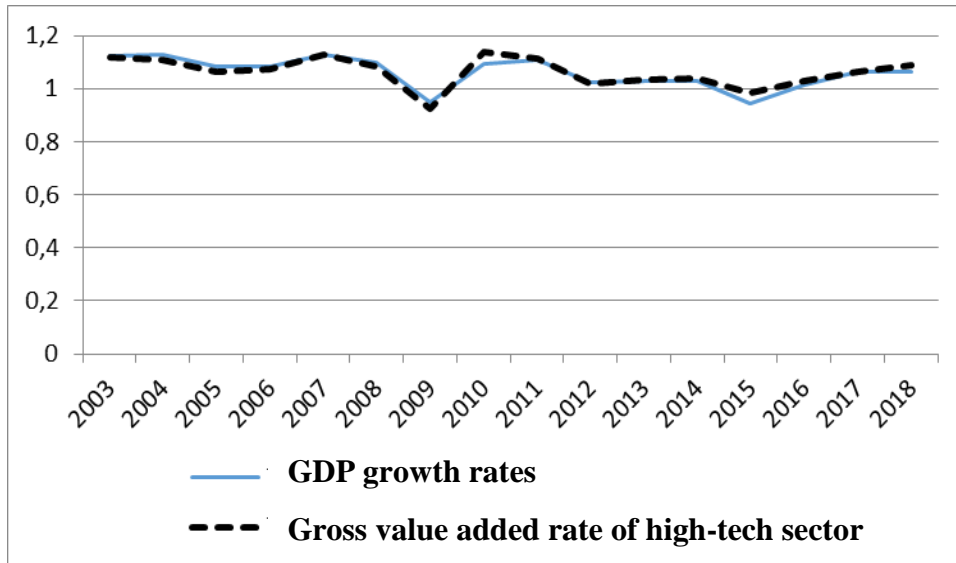


Figure 1. Dynamics of GDP growth and gross value added of the high-tech sector in the world in 2003-2018
Source: calculated by the authors based on data (National Science Foundation 2018)

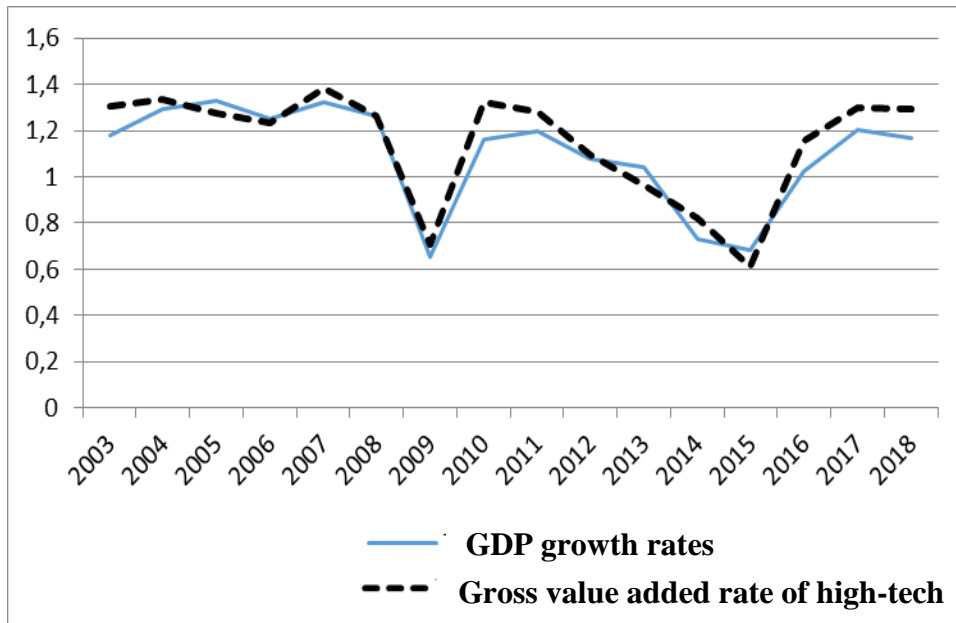


Figure 2. Dynamics of GDP growth and gross value added of the high-tech sector in Ukraine in 2003-2018
Source: calculated by the authors based on data (National Science Foundation 2018)

The analysis of gross value added of the high-tech sector of Ukraine in comparison with other sectors of the economy in the context of structural components is presented in Table 2.

Table 2. Structure of gross value added of the high-tech sector of Ukraine in 2018, %

KVED	Labour remuneration	Production-related taxes	Gross profit
C20. Production of chemicals and chemical products	80.2	1.5	18.2
C21. Production of pharmaceutical products	54.7	0.5	44.7
C26. Production of computers, electronic and optical products	83.3	0.7	16.0
C27. Production of electrical equipment	58.5	0.6	40.9
C28. Production of machinery and equipment	67.2	0.6	33.9
C29. Production of motor vehicles, trailers and semi-trailers	123.5	0.7	-24.2
C30. Production of other vehicles	65.0	0.5	34.5
J58-J60. Publishing activities; production of films and videos, television programs, publication of sound recordings; radio and television broadcasting activities	59.9	1.4	39.7
J61. Telecommunications (electrocommunication)	32.9	0.4	67.7
J62-J63. Computer programming, consulting and provision of information services	31.1	2.4	66.5
M72. Research and development	63.5	0.2	36.6
High-tech sector (total)	50.1	1.2	49.1
Manufacturing sector (processing industry)	56.2	1.0	43.3
Agricultural sector (agriculture, forestry, hunting)	20.6	0.8	79.5
Trade sector (wholesale and retail trade)	41.5	0.9	57.6

Source: calculated by the authors based on data (State Statistics Service of Ukraine 2020)

A characteristic feature of the structure of gross value added in the high-tech sector is the highest values of shares (compared to other sectors) of remuneration and tax deductions, which indicates the realization of economic interests, first, of employees and the state. Consequently, the high-tech sector performs important social and tax functions in the macro-system, ensures the reproduction of the country's labour and intellectual potentials, and is one of the basic resource-forming sectors of the national economy (Nikishyna 2017). The development of the high-tech sector should become one of the priorities of the state economic policy, since the growth of the share of its gross value added will primarily contribute to an increase in jobs, wages and tax revenues, which is due to the structural features of the indicator in this sector.

5. Determination of strategic directions for increasing the gross value added of the high-tech sector of the national economy

Determination of strategic directions for increasing the gross value added of the high-tech sector of the national economy is proposed using the BCG Matrix adapted to the needs of this research. Traditionally, the BCG Matrix is used by enterprises to form a product and competitive strategy. The method of classifying the company's business lines according to the BCG Matrix provides an understanding of the state of the company's products on the market. Of all the variety of factors that characterize the state of products in the market, only two main ones are selected for building the Matrix: sales growth (profitability) of the product and its market share relative to the main competitors. After all, a product can make a small profit in a fast-growing market, and a highly profitable product can be obsolete.

It is proposed to determine the strategic directions for the development of the high-tech sector in the context of the types of economic activity that form it.

There are examples of applying the BCG Matrix to the classification of types of economic activity of the country's economy as a whole (Institute of Socio-Economic Research 2016), where the added value generated by a particular type of economic activity and the share in the total export volume are chosen as criteria. This approach

provides an understanding of the prospects of economic activities, depending on their significance for the economy and on their export orientation.

The methodological approach proposed for this research value-added and output as classification criteria, considering the dynamics of development. Depending on value added generated by a particular type of economic activity and its growth rate, all types of economic activity can be divided into four categories (groups): strategic leaders (I quadrant), potential leaders (II quadrant), current leaders (IV quadrant) and problem activities (III quadrant) (Figure 3). On the abscissa axis, the high-tech economic activities are located in accordance with the share of gross value added in output, adjusted by the subsidy coefficient (formulas 1, 2) (Institute of Socio-Economic Research 2016).

$$GVA'_i = \frac{GVA_i}{X_i} * S_i \tag{1}$$

where GVA'_i is an adjusted indicator of gross value added of a certain type of economic activity i ,

GVA_i is a gross value added of a certain type of economic activity i ,

X_i is an output by a type of economic activity i ,

S_i is a subsidy coefficient.

To exclude from priority those types of economic activity that receive subsidies, it is proposed to multiply them by the subsidy coefficient, which has indicators below one, or 1 - if there are no subsidies.

The subsidy coefficient is calculated using the following formula:

$$S_i = 1 - \frac{sb_i}{SB} \tag{2}$$

where S_i is a subsidy coefficient,

sb_i is subsidies received by a certain type of economic activity i ,

SB is a total amount of subsidies.

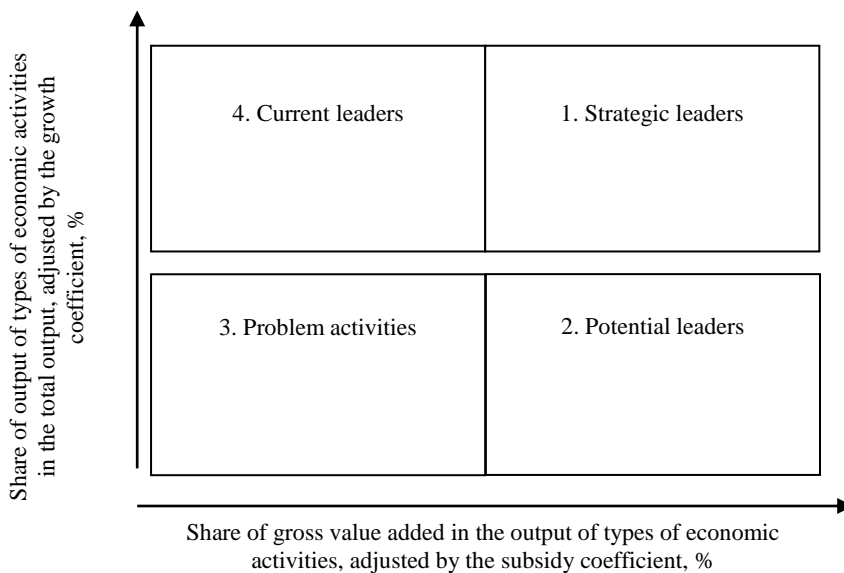


Figure 3. Matrix "Development dynamics – gross value added" and strategic groups of types of economic activities
 Source: developed by the authors based on (Institute of Socio-Economic Research 2016)

Indicators of gross value added in output for high-tech economic activities were calculated based on the cost-output tables for 2018 (Tables 3, 4).

Table 3. Calculation of the adjusted indicator of the share of gross value added of the high-tech sector of the Ukrainian economy in the output in 2018

KVED	Gross value added, million UAH	Output, million UAH	Share of gross value added in output structure, %	Subsidy coefficient	Share of gross value added in output structure (adjusted), %
C20. Production of chemicals and chemical products	10 210	88 038	11.6	1.000	11.6
C21. Production of pharmaceutical products	12649	41464	30.5	1.000	30.5
C26. Production of computers, electronic and optical products	5541	18553	29.9	1.000	29.9
C27. Production of electrical equipment	14039	48186	29.1	1.000	29.1
C28. Production of machinery and equipment	23676	75769	31.2	0.980	30.6
C29. Production of motor vehicles, trailers and semi-trailers	7241	29402	24.6	1.000	24.6
C30. Production of other vehicles	19674	57593	34.2	1.000	34.2
J58-J60. Publishing activities; film, videos, TV shows production, programs, sound recordings publications; radio and television broadcasting	12796	36166	35.4	0.994	35.2
J61. Telecommunications (electrocommunication)	37182	68603	54.2	0.982	53.2
J62-J63. Computer programming, consulting and provision of information services	88850	182299	48.7	1.000	48.7
M72. Research and development	22367	30852	72.5	0.997	72.3

Source: calculated by the authors based on data (State Statistics Service of Ukraine 2020)

Table 4. Calculation of the subsidy coefficient for the high-tech sector of the Ukrainian economy in 2018

KVED	Subsidies related to production, million UAH	Share of sector subsidies in the total amount of subsidies, %	Subsidy coefficient
C20. Production of chemicals and chemical products	-	-	1.000
C21. Production of pharmaceutical products	-	-	1.000
C26. Production of computers, electronic and optical products	-	-	1.000
C27. Production of electrical equipment	-	-	1.000
C28. Production of machinery and equipment	405	2.0	0.980
C29. Production of motor vehicles, trailers and semi-trailers	-	-	1.000
C30. Production of other vehicles	-	-	1.000
J58-J60. Publishing activities; production of films and videos, television programs, publication of sound recordings; radio and television broadcasting activities	122	0.6	0.994
J61. Telecommunications (electrocommunication)	370	1.8	0.982
J62-J63. Computer programming, consulting and information services provision	-	-	1.000
M72. Research and development	68	0.3	0.997

Source: calculated by the authors based on data (State Statistics Service of Ukraine 2020)

On the ordinate axis, the types of economic activity of the high-tech sector of the Ukrainian economy are located in accordance with the share in the total output adjusted for the growth coefficient (Table 5).

Table 5. Calculation of the adjusted share of high-tech sector output by type of economic activity in the total output in 2018

KVED	Output in basic prices in 2013, million UAH	Output in basic prices in 2018, million UAH	Share of output of types of economic activities in the total output in 2018, %	Basic growth coefficient 2018/2013	Output share adjusted by growth coefficient, %
C20. Production of chemicals and chemical products	54 257	88 038	1.17	1.623	1.91
C21. Production of pharmaceutical products	13785	41464	0.55	3.008	1.66
C26. Production of computers, electronic and optical products	7719	18553	0.25	2.404	0.60
C27. Production of electrical equipment	22498	48186	0.64	2.142	1.38
C28. Production of machinery and equipment	40274	75769	1.01	1.881	1.90
C29. Production of motor vehicles, trailers and semi-trailers	12493	29402	0.39	2.353	0.92

C30. Production of other vehicles	49013	57593	0.77	1.175	0.90
J58-J60. Publishing activities; production of films and videos, television programs, publication of sound recordings; radio and television broadcasting activities	19851	36166	0.48	1.822	0.88
J61. Telecommunications (electrocommunication)	46222	68603	0.92	1.484	1.36
J62-J63. Computer programming, consulting and information services provision	33196	182299	2.43	5.492	13.36
M72. Research and development	17149	30852	0.41	1.799	0.74
Total in economy	3189558	7493469	100.00	-	-

Source: calculated by the authors based on data (State Statistics Service of Ukraine 2020, 2015)

When determining strategic development directions for the high-tech sector, it is especially important to consider the dynamics of the development of relevant types of economic activity. After all, a particular type of economic activity can at present occupy a small share in the total output, but have a high growth rate, which will help to increase the share of this type of economic activity over time.

Based on the above-mentioned calculations, the types of economic activity of the high-tech sector of the Ukrainian economy are classified into four strategic groups: strategic leaders, current leaders, potential leaders, and problem activities (Table 6).

Indicators of the adjusted share of gross value added and the share of output in the total volume for each type of economic activity of the high-tech sector of the Ukrainian economy were compared with the threshold value (for gross value added – 30%, for output - 1%): if the indicator exceeds the threshold value, it is given a positive sign "+", if it lags behind – a negative sign "-".

The first group of "strategic leaders" usually includes unique innovative sectors that generate high added value, attract highly qualified specialists, have a significant market potential and can ensure a leap in the country's development, bringing it closer to the high-tech economies of the world. These are, in particular, such economic activities as the production of pharmaceutical products; the production of machinery and equipment; telecommunications; computer programming, consulting and information services provision. It should be noted that the production of machinery and equipment, as well as computer programming, consulting and information services provision are export-oriented (the share of these types of economic activity in the total export volume of the country is one of the highest in the high-tech sector – 2.98% and 5.88%, respectively). Ukraine is ranked 9th in the world in terms of exports of ICT services. Telecommunications services, computer and information services account for 23.4% of the total export of services from Ukraine to the EU countries. At the same time, these activities require significant investment, and considering the uniqueness of some of them, are high-risk. Ukraine has the potential to develop these activities of the economy due to the availability of qualified personnel and the education system that can provide it with the main factor of production – human capital. The role of the state in the development of the above-mentioned economic activities should be supportive and implemented through tax incentives for hiring highly qualified personnel and investing in innovations and scientific developments, state guarantees, lending and insurance (Institute of Socio-Economic Research 2016).

Table 6. Classification of the types of economic activity of the high-tech sector of the Ukrainian economy by strategic groups

KVED	Share of the output of the types of economic activity in the total output, adjusted by the growth coefficient, %	Share of gross value added in the output of types of economic activities, adjusted by the subsidy coefficient, %
Strategic leaders (++)		
C21. Production of pharmaceutical products	1.66	30.5
C28. Production of machinery and equipment	1.90	30.6
J61. Telecommunications (electrocommunication)	1.36	53.2
J62-J63. Computer programming, consulting and information services provision	13.36	48.7
Potential leaders (- +)		
C30. Production of other vehicles	0.90	34.2
J58-J60. Publishing activities; production of films and videos, television programs, publication of sound recordings; radio and television broadcasting activities	0.88	35.2
M72. Research and development	0.74	72.3
Current leaders (+-)		
C20. Production of chemicals and chemical products	1.91	11.6
C27. Production of electrical equipment	1.38	29.1
Problem activities (--)		
C26. Production of computers, electronic and optical products	0.60	29.9
C29. Production of motor vehicles, trailers and semi-trailers	0.92	24.6

Source: developed by the authors

The second group – "potential leaders" – includes activities with a high level of added value and low development dynamics, but they have the potential to enter international markets or the potential for import substitution in the domestic market. This group includes such types of economic activities as the production of other vehicles, in particular ships and boats, trains and locomotives, aircraft and spacecraft, as well as parts for these vehicles, related equipment; publishing activities; production of films and videos, television programs, sound recordings; radio and television broadcasting activities, telecommunications; research and development.

Economic activities classified as "current leaders" generate relatively lower value added in the high-tech sector and depend on the price environment of foreign markets. However, today they are competitive in the world market. This group includes the production of chemicals and chemical products; the production of electrical equipment. These economic activities account for 2.9% and 1.9% of export, respectively.

"Problem sectors" are characterized by low development dynamics and produce with relatively low added value. This group includes the production of motor vehicles, trailers and semi-trailers, as well as the production of computers, electronic and optical products.

Strategic directions for increasing the gross value added of the high-tech sector of the Ukrainian economy based on the above-mentioned classification are shown in Table 7. The proposed classification helps to understand the risks from an inertial scenario, that is, the development of the situation by gravity without an appropriate policy, as well as to reveal strategic directions for implementing a progressive scenario. Policy measures aimed at increasing the gross value added of economic activities in the high-tech sector are proposed to be systematized according to the elements of the innovation system: state regulation, supply and demand, infrastructure, human resources.

The proposed methodological approach, based on the classification of economic activities of the high-tech sector into strategic groups, provides a differentiated approach to the development and reveals the sources of strategic directions for increasing gross value added.

Table 7. Strategic directions for increasing the gross value added of the high-tech sector of the Ukrainian economy

Strategic groups	Types of economic activity	Consequences of inertial scenario	Strategic directions of progressive scenario	Possible measures
Strategic leaders	C21. Production of pharmaceutical products C28. Production of machinery and equipment J61. Telecommunications J62-J63. Computer programming, consulting and information services provision	- loss of leading positions; - non-use of export potential	- maintenance and increase of gross value added; - attraction of investment; - integration into global value chains; - export development; - directing the best resources, as these types of economic activity is a stable source of profit	- <i>state regulation</i> : creating a favourable investment environment; preferential tax regime for companies that make a profit from the sale of intellectual property; - <i>demand</i> : introduction in other sectors of the domestic economy; export support programs; - <i>supply</i> : introduction of a program within which private entrepreneurs can use a certain percentage of the amount of their annual tax payments for investing in any innovative enterprises/start-ups; - <i>infrastructure</i> : development of venture funds; - <i>human resources</i> : introduction of a scheme in which employees become shareholders/participants of companies, at which they work (ESOP), encourages personal interest of employees and business owners in the development of companies and increasing their capitalization.
Potential leaders	C30. Production of other vehicles J58-J60. Publishing activities; production of films and videos, television programs, publication of sound recordings; radio and television broadcasting activities M72. Research and development	- decrease in gross value added due to reduced output	- stimulation of the dynamics of development of these activities; - attraction of investment; - stimulation of demand	- <i>state regulation</i> : creation of a favourable investment environment; - <i>demand</i> : public procurement; import substitution programs; - <i>supply</i> : improvement of the competitiveness of domestic products; - <i>infrastructure</i> : science and technology parks, business incubators, clusters, etc.; - <i>human resources</i> : internationalization of scientific activity.
Current leaders	C20. Production of chemicals and chemical products C27. Production of electrical equipment	- transformation into problem activities while reducing the dynamics of development	- increase in share of gross value added in the output; - support for high development dynamics	- <i>state regulation</i> : stimulation of innovation activity; - <i>demand</i> : attraction of foreign investors; import substitution programs; - <i>supply</i> : introduction of a program within which private entrepreneurs can use a certain percentage of the amount of their annual tax payments to invest in innovative projects, update/implement technologies; - <i>infrastructure</i> : creation of international industrial parks that will connect domestic enterprises with foreign technology developers;

				- <i>human resources</i> : creation of international technology centres that contribute to the improvement of technological skills.
Problem sectors	C26. Production of computers, electronic and optical products C29. Production of motor vehicles, trailers and semi-trailers	- reduction or loss of activities	- penetration into specific markets; - improvement of product competitiveness; - increase of sectors profitability	- <i>state regulation</i> : stimulation of export activities; - <i>demand</i> : development of "smart" production; - <i>supply</i> : increase of products competitiveness; - <i>infrastructure</i> : creation of cross-sectoral clusters; - <i>human resources</i> : creation of international technology centres that contribute to improvement of technological skills.

Source: developed by the authors

5. Conclusions

1. High-tech and science-intensive sectors play a crucial role in the development of countries' economies. In this sector, innovations are created and implemented, new markets and jobs are created, this sector contributes to increase of labour productivity and acceleration of the development of other sectors of the economy, achievement of the Sustainable Development Goals, it forms the Fourth Industrial Revolution, promotes the introduction of advanced digital production technologies, creates new opportunities for production development and neoindustrialization.
2. The structure of the high-tech sector should cover both the sphere of high-tech material production and the sphere of providing high-tech services.
3. Characteristic feature of the structure of gross value added of the high-tech sector is the highest values of shares (compared to other sectors) of remuneration and tax deductions, which indicates the realization of economic interests, first, of employees and the state. Consequently, an increase in the share of its gross value added will primarily contribute to an increase in jobs, wages and tax revenues.
4. The developed methodological approach to classifying the types of economic activity of the high-tech sector into strategic groups provides a differentiated approach to the development and reveals the sources of strategic directions for increasing gross value added. Value added and output were selected as classification criteria, considering the dynamics of development. Depending on the value added generated by a particular type of economic activity and its growth rate, all types of economic activity can be divided into four groups: strategic leaders, potential leaders, current leaders, and problem activities. The proposed methodological approach helps to identify the risks from an inertial scenario, that is, the development of the situation by gravity without an appropriate policy, as well as to determine the strategic directions for implementing a progressive scenario.
5. Systematic development of the high-tech sector is possible if the appropriate policy is formed based on the national innovation system, the elements of which are: state regulation in the field of innovation; supply and demand of innovations; market infrastructure for innovations; human resources. According to these elements, the policy measures aimed at increasing the gross value added of economic activities of the high-tech sector, which have their own characteristics depending on the classification group, are systematized.

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