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## КУМУЛЯТИВНА МОДЕЛЬ ЗБІЛЬШЕННЯ ВАЛОВОЇ ДОДАНОЇ ВАРТОСТІ ВИСОКОТЕХНОЛОГІЧНОГО СЕКТОРУ НАЦІОНАЛЬНОЇ ЕКОНОМІКИ

**Актуальність.** Високотехнологічний сектор відіграє визначальну роль в соціально-економічному розвитку держав світу та є ключовим фактором їх конкурентоспроможності. Україна є державою із потужним науковим та інноваційним потенціалом, який спроможний забезпечити вихід на світові лідируючі позиції. Проте Україна суттєво відстає у розвитку свого високотехнологічного сектору від багатьох інших країн світу, що вимагає розробки системних заходів з подолання ситуації, яка склалася.

**Мета та завдання.** На основі аналізу взаємовпливів збільшення валової доданої вартості високотехнологічного сектору та відтворювального процесу національної економіки на інноваційному базисі розробити концептуальні засади формування системи стимулів збільшення валової доданої вартості високотехнологічних сфер підприємницької діяльності.

**Результати.** В статті розкрито роль високотехнологічного сектору в національній економіці і на цій основі запропоновано кумулятивну модель збільшення валової доданої вартості високотехнологічного сектору національної економіки, яка розкриває відповідні взаємовпливи та дозволяє підійти до розробки стимулів збільшення валової доданої вартості високотехнологічного сектору з системних позицій.

**Висновки.** Валова додана вартість, створена високотехнологічним сектором, є джерелом конкурентних переваг для національної економіки: вона забезпечує технологічну основу для інноваційного розвитку всіх галузей економіки, робочих місць для висококваліфікованої робочої сили, скорочення відпливу капіталу за рахунок залучення його до інвестування в інноваційну діяльність, збільшення доходів бюджету. Стимулювання розвитку високотехнологічного сектору має здійснюватись системно та охоплювати усі елементи кумулятивної моделі збільшення валової доданої вартості високотехнологічного сектору національної економіки, а саме: зовнішньоекономічна інтеграція, підвищення продуктивності вітчизняних галузей на інноваційному базисі, збільшення фінансових ресурсів для розширеного відтворення інноваційного потенціалу та розвитку інноваційної системи.

**Ключові слова:** високотехнологічний сектор, національна економіка, валова додана вартість, кумулятивна модель.

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## CUMULATIVE MODEL OF INCREASING GROSS VALUE ADDED OF THE HIGH-TECH SECTOR OF THE NATIONAL ECONOMY

**Topicality.** 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.

**Aim and tasks.** Based on the analysis of mutual influence of gross value added of the high-tech sector and the reproductive process of the national economy on an innovative basis to develop a conceptual basis for the formation of a system of incentives for increasing the gross value of high-tech areas of entrepreneurial activity.

**Research results.** The article reveals the role of high-tech sector in the national economy and on this basis a cumulative model of increasing gross value of the high-tech sector of the national economy is proposed. The model reveals appropriate mutual influences and allows to approach the development of incentives for increasing the gross value of the high-tech sector from systemic positions.

**Conclusion.** Gross value added, created by the high-tech sector, is a source of competitive advantages for the national economy: it provides a technological basis for innovation development of all sectors of the economy, workplaces for highly skilled labor, reduction of capital outflow due to the involvement of its investment in innovation activities, increase of budget revenues. Stimulating the development of the high-tech sector should be systematic and cover all elements of the cumulative model of increasing gross value added of the high-tech sector of the national economy, namely: foreign economic integration, increase of productivity of domestic industries on an innovative basis, increase financial resources for expanded reproduction of innovation potential and development of the innovation system.

**Keywords:** high-tech sector, national economy, gross value added, cumulative model.

### Problem statement and its connection with important scientific and practical tasks.

Gross value added, created by a high-tech sector of Ukraine, is a source of competitive advantages for the national economy, namely:

- creation of a technological basis for innovation development of sectors of the economy: in 2019 the share of the use of high-tech sector products in the total volume of all sectors amounted to 9.5%;
- creation of workplaces for highly skilled workers: in 2019 the share of labor costs of the high-tech sector in the total volume of all sectors amounted to 8.7%;
- reduction of capital outflow due to its involvement into investment in innovation activity: in 2019 the share of gross profit of the high-tech sector in the total volume of all sectors amounted to 8.7%;
- revenues to the budget and growth of the well-being: in 2019 the share of production taxes of the high-tech sector in the total volume of all sectors amounted to 13%;
- development of entrepreneurial activity: in 2019 the share of medium, small and micro-entrepreneurship entities in the total value added of the production of business entities was as follows: industry - 51.3%, information and telecommunications - 71.1%, professional, scientific and technical activity - about 45% [3, p. 40-41].

All analyzed indicators, with the exception of labor costs of employees and taxes related to production, have a positive dynamics in 2010 compared to 2014 (Table 1). The share of gross value added of the high-tech sector in the total volume of all sectors in 2019 amounted to 8.7%.

Table 1

**Structure and dynamics of gross value added of the high-tech sector of Ukraine in 2019,  
million UAH**

KVED	Output		Labour remuneration		Gross profit		Production-related taxes		Gross value added	
	2014	2019	2014	2019	2014	2019	2014	2019	2014	2019
C20. Production of chemicals and chemical products	53380	95157	5800	9051	-283	655	328	172	5844	9878
C21. Production of pharmaceutical products	17065	47467	2976	8140	2081	6019	106	77	5163	14236
C26. Production of computers, electronic and optical products	8424	20636	1878	5188	461	910	57	45	2396	6143
C27. Production of electrical equipment	24070	47888	5326	7984	1536	5460	130	87	6992	13531
C28. Production of machinery and equipment	37214	84665	8716	18839	2697	7252	231	160	11619	25744
C29. Production of motor vehicles, trailers and semi-trailers	13539	26849	2692	10198	348	-3957	80	62	3120	6303
C30. Production of other vehicles	28901	65329	7486	13679	4248	8308	180	105	11914	22092

J58-J60. Publishing activities; production of films and videos, television programs, publication of sound recordings; radio and television broadcasting activities	16365	43807	3960	9466	1540	6170	136	221	5458	15725
J61. Telecommunications (electrocommunication)	44786	76153	9453	14526	13157	27321	1819	185	23852	41689
J62-J63. Computer programming, consulting and provision of information services	43965	254550	10662	40201	12255	82235	497	2817	23414	125253
M72. Research and development	17968	34006	7624	12822	4935	5965	67	47	12626	18698
The share of the high-tech sector in the total volume of all types of economic activity, %	9,1	9,5	9,1	8,7	6,6	8,7	13,5	13,0	8,1	8,7

Source: calculated by the author according to the data [1, p. 150-165; 2, p. 100-115]

Considering this, research of ways to increase gross value added of the high-tech sector is an actual scientific and applied task.

**Analysis of recent publications on the problem.** The issue of finding ways to increase the gross value added of the high-tech sector was raised in the works of such Ukrainian scientists as Burkynskyi B.V., Laiko O.I. [4], Shlafman N.L. [5], Zvieriakov M.I. [6]. 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, Rojcek 2007) [7, 8], OECD countries (Ceglowski 2015) [9], EU countries (Parker 2000) [10].

**Allocation of previously unsolved parts of the general problem.** For the national economy the development of a conceptual basis for the formation of a system of stimulating the increase in gross value added of high-tech areas of entrepreneurial activity considering the peculiarities of the reproductive process of the national economy on the innovative basis is a relevant scientific task.

**Formulation of research objectives (problem statement).** Based on the analysis of mutual influence of gross value added of the high-tech sector and the reproductive process of the national economy on an innovative basis to develop a conceptual basis for the formation of a system of incentives for increasing the gross value of high-tech areas of entrepreneurial activity.

**An outline of the main results and their justification.** In order to approach the study issue with system positions, we offer the use of a cumulative approach. As a prototype it was chosen the cumulative model of a region's competitiveness [11]: growth of volumes of gross regional product –intensification of innovative activities– increasing the labor productivity level –reduction of relative costs of wages–reduction of the cost of export products– increasing demand for export products (Figure 1).

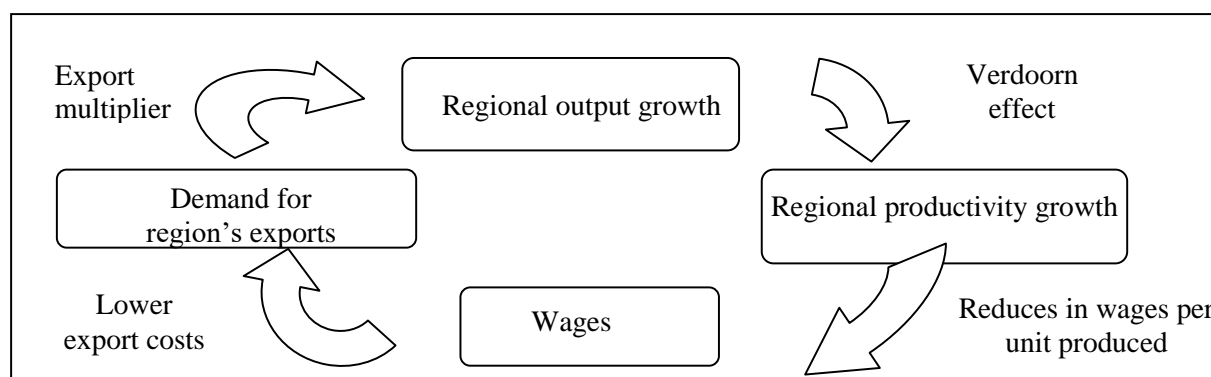


Fig. 1. Cumulative causation and regional competitiveness

Source: [11, p. 2-16 – 2-17]

A key element of the theory of cumulative competitiveness of the region is the so-called Verdoorn effect, which explains the mechanism of the interaction of increasing the volumes of gross regional product and labor productivity. Thus, increasing the volumes of gross regional product encourages local companies to introduce technological changes and intensify innovative activities, resulting in increasing the labor productivity level.

The proposed cumulative model of increasing gross value added of the high-tech sector of the national economy is presented on Figure 1:

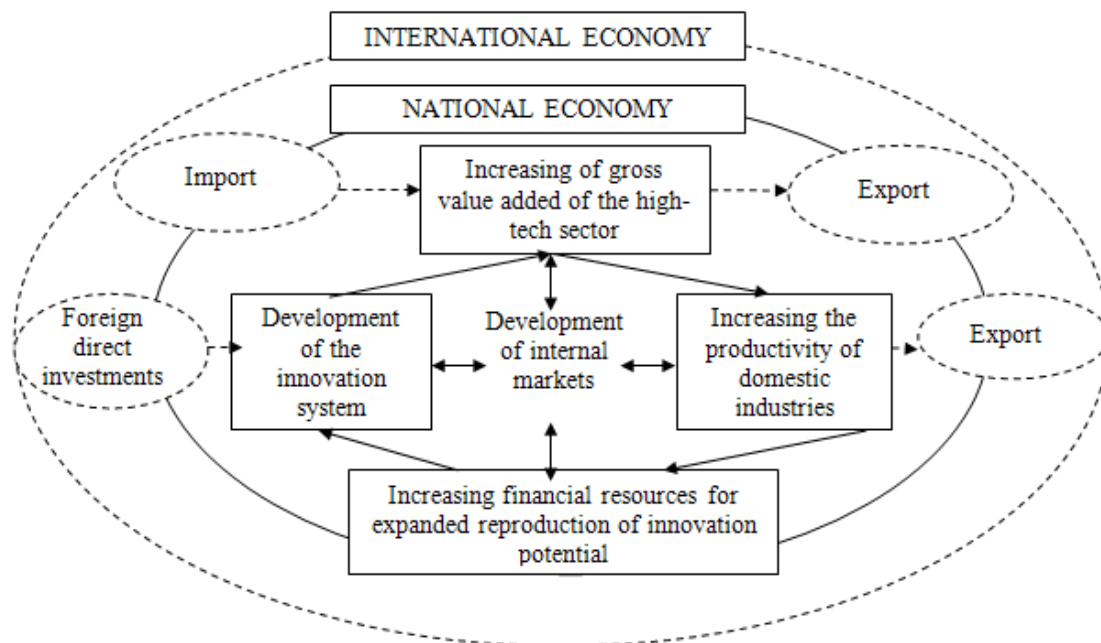


Fig. 2. Cumulative model of increasing gross value added of the high-tech sector of the national economy  
Developed by the author

The proposed cumulative model reflects the mutual influence of gross value added of the high-tech sector and the reproductive process of the national economy on an innovation basis in the interests of the development of domestic markets. On the one hand, the presence of growth factors (investments, human capital, innovation, institutional framework) is necessary to increase gross value added. On the other hand, gross value added, created by the high-tech sector, is a factor of innovation development of all sectors of the economy. The logic of the cumulative effect is as follows: increase in gross value added of the high-tech sector - usage of technologies by domestic enterprises of all sectors – increase of productivity of domestic enterprises on an innovation basis - increase in financial resources for expanded reproduction of innovation potential - increase in expenditures for the development of national and regional innovation systems - intensification of innovation activities - increase in gross value added of the high-tech sector. So, as the national economy functions in a not isolated space, but it is integrated into the world economy, the factor of foreign economic integration should also be considered in the model: import is a source of technologies and knowledge for the national economy, export of national high-tech products and foreign investment should become sources of financial revenues for national innovation development.

Characteristics of the elements of the cumulative model of increasing gross value added of the high-tech sector of the national economy are presented in Table 2.

The priority task of state stimulation of the development of the domestic high-tech sector in the direction of its external integration is determined to ensure import substitution. It is also important to increase the competitiveness of domestic manufacturers of high-tech products and services both in the domestic and foreign markets.

The priority task of state stimulation of the development of the domestic high-tech sector in the direction of using its products and services by other sectors of the economy is the implementation of the policy of new industrialization and sustainable development policy, the development of the agro-industrial complex on an innovation basis. The main task of this group of incentives is a purposeful formation of demand for high-tech products of domestic sectors of the economy.

As incentives to increase financial resources for expanded reproduction of the innovation potential of the national economy, it is proposed: at the state level - provision of financing of research and development at the level of 3% of GDP, at the enterprise level - introduction of a mechanism for exemption from taxation of profit share, that is not removed from economic turnover and reinvested in the development and / or implementation of high-tech products and / or services.

Table 2

**Characteristics of the elements of the cumulative model of increasing gross value added of the high-tech sector of the national economy**

<b>Model element</b>	<b>Description</b>	<b>Advantages for national economy</b>	<b>Risks of inertial development</b>	<b>Tasks for state incentives</b>
1. Increasing of gross value added of the high-tech sector	On the one hand, it requires growth factors (investments, human capital, innovations, institutional framework). On the other hand, this element is a factor of innovation development of sectors of the economy	Production of innovations for sectors of the economy, creation of an innovation basis for development, integration into global value added chains	Country lagging in innovation development, incompetibility of economy	Provision of high-tech sector with the necessary factors of development: finance, human capital, innovations, favorable institutional environment; Stimulating domestic demand
2. Import of high-tech products	Countries, lagging behind in innovation development, that is characteristic for Ukraine, have a significant share of high-tech import	Getting new and technologies	Import dependence on foreign technologies, degradation of national innovation potential	Implementation of import substitution policy
3. Export of high-tech products	The global high-tech market develops rapidly and demonstrates growing demand and profitability	Financial support of the national economy through tax revenues from exports, development of export-oriented productions in the country, creation work places	Brain drain, orientation on foreign value added chains	Stimulating the direction of revenue from exports to innovation development
4. Increasing the productivity of domestic industries on the innovation basis	The high-tech sector is a source of innovation for the national economy, it provides an innovation basis for new industrialization	Implementation of innovations contributes to increasing the productivity of domestic industries, as well as increasing their competitiveness, growth of domestic exports	De-industrialization, loss of competitive positions of the national economy, reducing budget revenues	Stimulating national economy demand for innovations
5. Increasing financial resources for expanded reproduction of innovation potential	High-tech sectors and sectors that use its products are source of budget revenues	Additional budget revenues become a source of financial support for the development of the national innovation system	Lack of financial support for the development of the national innovation system, lagging in the country's innovation development	Providing financial opportunities for innovations; Ensuring targeted use on innovation development of revenues from the high-tech sector
6. Development of the innovation system	National and regional innovation systems provide institutional basis for innovation development in the country and its regions	Development of factors needed to increase the high-tech sector	Decrease of the high-tech sector	Formation of integral innovation systems at the national and regional levels; Attraction of foreign investment

Developed by the author

A developed innovation system is a prerequisite for increasing gross value added of the high-tech sector, as it provides its necessary development factors (innovations, finance, human capital) and provides an innovation environment. The main task of this group of incentives is determined by the formation of integral innovation systems at the national and regional levels. Incentives should develop all elements of the innovation system, namely: institutional environment, demand, supply of innovations, innovation infrastructure, human resourcing.

### **Conclusions and perspectives of further research**

Gross value added, created by the high-tech sector, is a source of competitive advantages for the national economy: it provides a technological basis for innovation development of all sectors of the economy, workplaces for highly skilled labor, reduction of capital outflow due to the involvement of its investment in innovation activities, increase of budget revenues. And, accordingly, the welfare of the population increases, business activity is developed. This determines the relevance of implementation of incentives for increasing the gross value added of the high-tech areas of entrepreneurial activity.

In order to disclose the mutual influences of increasing the gross value of the high-tech sector and the reproduction of the national economy on the innovation basis, a cumulative model of increasing gross value of the high-tech sector of the national economy is proposed, the logic of which is as follows: increase in gross value added of the high-tech sector - usage of technologies by domestic enterprises of all sectors - increase of productivity of domestic enterprises on an innovation basis - increase in financial resources for expanded reproduction of innovation potential - increase in expenditures for the development of national and regional innovation systems - intensification of innovation activities - increase in gross value added of the high-tech sector. The factor of foreign economic integration is also considered in the aspect of its intensifying role in the development of the domestic high-tech sector.

The cumulative model is a conceptual basis for the systematization of incentives for increasing the gross value added of the high-tech sector considering its elements: foreign economic integration, increased productivity of domestic industries on an innovation basis, increase financial resources for expanded reproduction of innovation potential and development of the innovation system.

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