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Maryna Tatar
Ph.D. in Economics, Associate Professor,
Associate Professor of the Management and Business Administration Department,
National Aerospace University "Kharkiv Aviation Institute"
ORCID: https://orcid.org/0000-0002-1111-7103

Valeriia Zaburanna
Master's degree student,
National Aerospace University "Kharkiv Aviation Institute"

Татар Марина Сергіївна, Забуранна Валерія Андріївна
Національний аерокосмічний університет імені М. Є. Жуковського
«Харківський авіаційний інститут»

MECHANISMS OF THE BUSINESS ENTITIES INNOVATIVE DEVELOPMENT FINANCING IN THE FACE OF GLOBAL CHALLENGES

МЕХАНІЗМИ ФІНАНСУВАННЯ ІННОВАЦІЙНОГО РОЗВИТКУ СУБ'ЄКТІВ ГОСПОДАРЮВАННЯ ПІД ЧАС ГЛОБАЛЬНИХ ВИКЛИКІВ

Summary. Strengths and weaknesses of the innovative development of Ukraine are identified. Possible sources of Ukrainian enterprises innovative development funding were analyzed and factors influencing the financing of the business entities' innovative development were identified. The advantages and disadvantages of financing sources of innovative development are determined. The analysis of statistical data showed that the main source of financing innovations in the industry in Ukraine is the company's own funds. Mechanisms and tools for mobilizing financial resources for financing the innovative development of economic entities have been systematized. The results of modeling the impact of sources of financing on GDP and the volume of products sold by enterprises demonstrated the greater importance of financing enterprises at the expense of state budget funds for increasing the effectiveness of innovative activities.

Keywords: innovative interaction, global challenges, sources of financing, innovative development, tools, mechanisms, mobilization of financial resources, business entities.

Анотація. Проаналізовано динаміку Глобального індексу інновацій за 2017–2023 роки й встановлено, що Україна, навіть попри воєнний стан, має великий потенціал та передумови для інноваційного розвитку. Визначено сильні та слабкі сторони інноваційного розвитку України. Україна володіє могутнім інтелектуальним потенціалом, однак, основною перешкодою підвищення інноваційного розвитку підприємств України є недостатній обсяг фінансування, тому забезпечити сталий інноваційний розвиток можливо лише за умови фінансування інноваційної діяльності суб'єктів господарювання та всебічної комплексної державно-приватної взаємодії. Необхідне формування цілісного уявлення щодо фінансування інноваційного розвитку суб'єктів господарювання, що забезпечить відновлення в постковідний, воєнний та післявоєнний періоди, оновлення матеріальної бази, зростання обсягів виробництва, підвищення ділової активності, випуск конкурентоспроможної на світових ринках продукції. Проаналізовано можливі джерела фінансування інноваційного розвитку підприємств України й ідентифіковано фактори впливу на фінансування інноваційного розвитку суб'єктів господарювання. Визначено переваги та недоліки джерел фінансування інноваційного розвитку. Аналіз статистичних даних показав, що основним джерелом фінансування інновацій у промисловості України є власні кошти підприємств. Систематизовано механізми та інструменти мобілізації фінансових ресурсів для фінансування інноваційного розвитку суб'єктів господарювання. Результати моделювання впливу джерел фінансування на ВВП та обсяг реалізованої продукції (товарів, послуг) підприємств продемонстрували більш вагоме значення фінансування підприємств за рахунок коштів державного бюджету для збільшення результативності інноваційної діяльності, що може обумовлюватися мотивованістю підприємств у зв'язку з зацікавленістю державою в підвищенні інноваційності та конкурентоспроможності підприємств, а також підвищеною відповідальністю підприємств та необхідністю подання звітів до органів державної влади, пов'язаних з використанням наданих бюджетних коштів.

Ключові слова: інноваційна взаємодія, глобальні виклики, джерела фінансування, інноваційний розвиток, інструменти, механізми, мобілізація фінансових ресурсів, суб'єкти господарювання.

Problem statement. In the conditions of the global challenges, ultra-fast environmental changes, and formation of the knowledge economy, the ability of companies to create and use knowledge, preserve and effectively use the existing scientific and technical potential allows them to obtain competitive advantages and accelerate the socio-economic development of society. However, despite the high level of science, well-known scientific schools, and the high specific weight of specialists with higher education in the national economy, Ukraine is characterized by the crisis in innovation, which is mainly related to insufficient financing of Ukrainian business entities, lack of financial motivation for workers to promote innovation.

Analysis of recent research and publications. The search for ways to finance innovative activities is currently a topical subject of research by many scientists. In the article of Kolodyazhna I.V., Borblik K.E. [6] sources of financial support for innovative activities of business entities were considered, the volumes and dynamics of the structure of financing innovative activities in Ukraine were analyzed, the possibilities of expanding the sources of the enterprises' own financial resources for the activation of their innovative activities were highlighted.

Hovrak I.V. [4] carried out an analysis of financial support for innovative development and revealed the main characteristics of funding sources.

Kim J., Park S.Y. [5] analyzed the effects of various factors such as firm size, innovation activities, and governmental support on various types of innovation performance; product innovation, process innovation, organizational innovation and marketing innovation, and derived differentiated characteristics of innovative SMEs and discused in-depth implications through comparison with general companies.

Innovation-related governmental support refers to government-led tax cuts, financing, and provision of technological information and skilled human resources so that companies can unfold R&D activities and thus effectively create innovation.

Studies on the relationship between governmental support and innovation performance are divided largely into three types. First, most studies describe the positive effects of governmental support (Audretsch D.B., Link A.B., Scott J.T. [1]; Yoon J.W., Yoon S. [10]; Chung E.Y., Lee K.B., Choi M.K. [2]). Next, other studies are skeptical of the relationship between governmental support and innovation performance. Lastly, some studies focus on the complementary relationship between governmental support and corporate R&D. Such ambiguity in the influence of funding sources on the results of innovative activities of enterprises confirms the need to study this issue.

The purpose of the article is determination the mechanisms and tools for mobilizing financial resources to finance the business entities' innovative development.

The research is based on the confirmation of the following empirical hypotheses:

Hypothesis 1. Companies'innovation activities will influence innovation performance.

Hypothesis 2. Government support will influence innovation performance.

Summary of the main research material. Ukraine has great potential and prerequisites for innovative development. This is evidenced by the data of the Global Innovation Index. According to the data of the Global Innovation Index, in 2023, out of 132 countries, Ukraine entered the TOP-3 countries in terms of the economy innovativeness level in the category of "Lower middle-income" countries (Table 1).

However, unfortunately, in 2020 Ukraine took 45th place in the overall rating, and in 2022 it took 57th place, although in 2023 the country rose by 2 positions (Table 2).

The strengths and weaknesses of innovative activity are listed in Table 3.

The distribution of the volume of innovative activities financing in the industry of Ukraine by sources is given in Table 4.

In 2020 85,4% of the sources of financing innovative activities of industrial enterprises consisted of the enterprises' own funds. At the same time, the share of state budget funds decreased from 5,2% in 2018 to 1,9% in 2020 [8]. The share of own funds in the total financing of innovative activities at industrial enterprises of Ukraine fluctuated during 2010–2020 in the range of 53-97%. The paucity of financing of innovative activities in industry at the expense of local budgets, extrabudgetary funds and funds of Ukrainian investors is striking. The main source of financing innovations in Ukrainian industry remains the company's own funds.

According to Art. 18 of the Law of Ukraine "On Innovative Activities", the sources of financial support for innovative activities are [7]:

a) funds of the State Budget of Ukraine;

b) funds of local budgets and funds of the budget of the Autonomous Republic of Crimea;

c) own funds of the specialised state and municipal innovation financial and credit institutions;

d) own or borrowed funds of the subjects of innovation activities;

e) funds (investments) of any individuals and legal entities;

f) other sources not prohibited by the legislation of Ukraine.

So, the Ukrainian model of financing innovative activities provides for the following sources: own, borrowed and involved (Table 5).

The system of investment mechanisms includes mechanisms for mobilizing the enterprise's own funds; mechanisms for mobilizing loan funds; mechanisms for mobilizing the involved funds (Figure 1).

The multivariate regression models of dependence

Table 1 – Top 10 economies by income group (rank)

№	Country	Rank	№	Country	Rank
High-income			Upper middle-income		
1	Switzerland	1	1	China	12
2	Sweden	2	2	Malaysia	36
3	United States	3	3	Bulgaria	38
4	United Kingdom	4	4	Turkey	39
5	Singapore	5	5	Thailand	43
6	Finland	6	6	Brazil	49
7	Netherlands	7	7	Russian Federation	51
8	Germany	8	8	Serbia	53
9	Denmark	9	9	North Macedonia	54
10	Republic of Korea	10	10	Mauritius	57
Lower middle-income			Low-income		
1	India	40	1	Rwanda	103
2	Viet Nam	46	2	Madagascar	107
3	Ukraine	55	3	Togo	114
4	Philippines	56	4	Zambia	118
5	Indonesia	61	5	Uganda	121
6	Iran	62	6	Burkina Faso	124
7	Mongolia	68	7	Ethiopia	125
8	Morocco	70	8	Mozambique	126
9	Tunisia	79	9	Guinea	128
10	Uzbekistan	82	10	Mali	129

Source: developed by the authors based on [2]

Table 2 – Ukraine's place in the Global Innovation Index

Years	GII	Input rank	Output rank
2017	50	77	40
2018	43	75	35
2019	47	82	36
2020	45	71	37
2021	49	76	37
2022	57	75	48
2023	55	78	42

Source: developed by the authors based on [2]

Table 3 – Innovation strengths and weaknesses of Ukraine

Strengths	Rank	Weaknesses	Rank
Utility models by origin/bn PPP$ GDP	1	Operational stability for businesses	130
Females employed w/advanced degrees, %	2	Labor productivity growth, %	129
Software spending, % GDP	4	Gross capital formation, % GDP	124
ICT services exports, % total trade	6	GDP/unit of energy use	115
Government funding/pupil, secondary, % GDP/cap	10	VC recipients, deals/bn PPP$ GDP	97
Mobile app creation/bn PPP$ GDP	12	VC received, value, % GDP	90
Pupil-teacher ratio, secondary	14	Market capitalization, % GDP	75
Industrial designs by origin/bn PPP$ GDP	16	Loans from microfinance institutions, % GDP	52
Trademarks by origin/bn PPP$ GDP	22	Unicorn valuation, % GDP	48
		Global corporate R&D investors, top 3, mn US$	40

Source: developed by the authors based on [2]

Table 4 – Financing sources of innovation activities of industrial enterprises

Year	Innovation expenditure, million UAH	Including on account of							
		own funds of enterprises		state budget funds		funds of non-resident investors		funds of other sources	
		million UAH	% of the total expenditure for innovation	million UAH	% of the total expenditure for innovation	million UAH	% of the total expenditure for innovation	million UAH	% of the total expenditure for innovation
2010	8045,5	4775,2	59,4	87,0	1,1	2411,4	30,0	771,9	9,6
2011	14333,9	7585,6	52,9	149,2	1,0	56,9	0,4	6542,2	45,6
2012	11480,6	7335,9	63,9	224,3	2,0	994,8	8,7	2925,6	25,5
2013	9562,6	6973,4	72,9	24,7	0,3	1253,2	13,1	1311,3	13,7
2014	7695,9	6540,3	85,0	344,1	4,5	138,7	1,8	672,8	8,7
2015	13813,7	13427,0	97,2	55,1	0,4	58,6	0,4	273,0	2,0
2016	23229,5	22036,0	94,9	179,0	0,8	23,4	0,1	991,1	4,3
2017	9117,5	7704,1	84,5	227,3	2,5	107,8	1,2	1078,3	11,8
2018	12180,1	10742,0	88,2	639,1	5,2	107,0	0,9	692,0	5,7
2019	14220,9	12474,9	87,7	556,5	3,9	42,5	0,3	1147,0	8,1
2020	14406,7	12297,7	85,4	279,5	1,9	125,3	0,9	1704,2	11,8

Source: developed by the authors based on [8]

Table 5 – Advantages and disadvantages of sources of funding for business entities' innovative development

Sources of funding	Advantages	Disadvantages
Self-financing (depreciation deductions, mobilization of internal assets, proceeds from the sale of certain types of property, retained earnings, etc.)	– independence from various financial and credit institutions; – ensuring the financial stability of the enterprise, its solvency in the long term, reducing the risk of bankruptcy	– delayed payments limit the possibility of financing innovations at the expense of profit; – insufficient volume of own funds causes low innovative activity
Loans (long-term loans from financial and credit institutions, leasing, forfeiture, franchising, etc.)	– possibility of development of production, increase of profitability of own capital; – quick renewal of the main production assets without significant one-time costs; – financial leverage	– high interest rates; – deterioration of the financial results of project implementation; – high degree of risk; – issues of guarantees or collateral required for lending
Funds involved (budgetary funds at the state and local levels; domestic and foreign investments: grants, international programs, equity contributions from foreign investors, funds from foreign scientific foundations; issue of shares, etc.)	– accumulation of large financial resources by placing shares; – the ability to relatively freely maneuver the structure of these resources; – direct investments in the form of securities, fixed assets, industrial and intellectual property and rights to them are carried out on the basis of concluding partnership agreements on joint innovation activities	– involvement in competitive selection of innovative projects; – businesses find it difficult to attract significant amounts of investment resources; – placement of securities is a complex and expensive process; – insufficient development of the stock market; – additional issuance of securities may lead to dilution of the share package and raiding

Source: compiled by the authors based on [4]

of financial indicators on sources of funding for the enterprises' innovative development are built.

The general form of multivariate regression is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_p X_p + \varepsilon.$$

The initial data for building dependence models are presented in Table. 6.

The formation of a model of the dependence of the volume of GDP on the sources of innovative development financing:

$$Y_1 = f(X_1; X_2; X_3; X_4),$$

where Y_1 is GDP, million UAH;

X_1 – the amount of innovative activity financing by own funds of enterprises, million UAH;

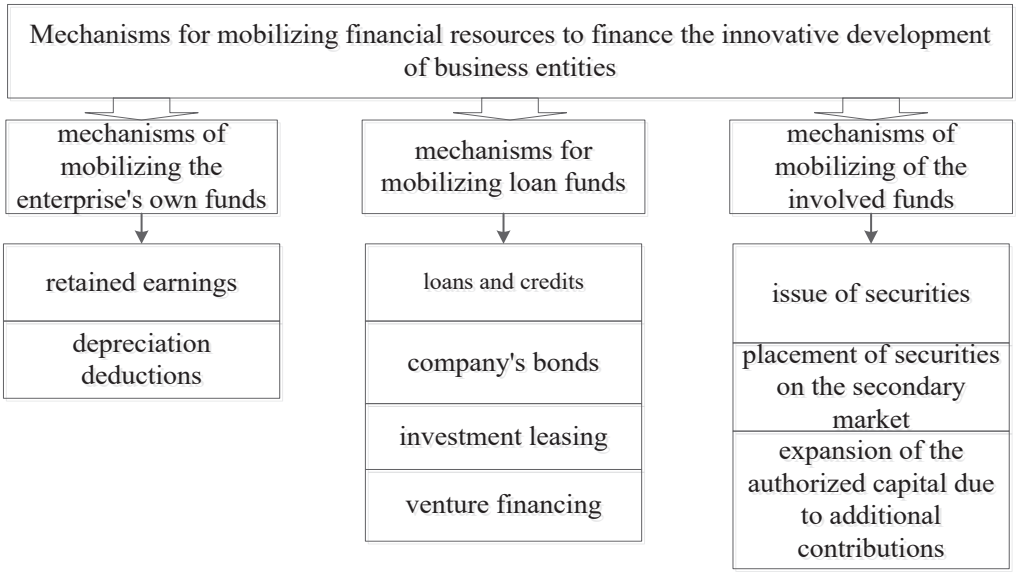

Figure 1 – Mechanisms of mobilization of resources to finance the business entities' innovative development

Source: developed by the authors

Table 6 – Output data for building dependency models

Year	Y1	Y2	X1	X2	X3	X4
2000	176128,0	200456,8	1399,3	7,7	133,1	217,0
2001	211175,0	210842,7	1654,0	55,8	58,5	203,1
2002	234138,0	229634,4	2141,8	45,5	264,1	562,4
2003	277355,0	289117,3	2148,4	93,0	130,0	688,4
2004	357544,0	400757,1	3501,5	63,4	112,4	857,3
2005	457325,0	468562,6	5045,4	28,1	157,9	520,2
2006	565018,0	551729,0	5211,4	114,4	176,2	658,0
2007	751106,0	717076,7	7969,7	144,8	321,8	2384,7
2008	990819,0	917035,5	7264,0	336,9	115,4	4277,9
2009	947042,0	806550,6	5169,4	127,0	1512,9	1140,6
2010	1079346,0	1043110,8	4775,2	87,0	2411,4	771,9
2011	1299991,0	1305308,0	7585,6	149,2	56,9	6542,2
2012	1404669,0	1367925,5	7335,9	224,3	994,8	2925,6
2013	1465198,0	1322408,4	6973,4	24,7	1253,2	1311,3
2014	1586915,0	1428839,1	6540,3	344,1	138,7	672,8
2015	1988544,0	1776603,7	13427,0	55,1	58,6	273,0
2016	2385367,0	2158030,0	22036,0	179,0	23,4	991,1
2017	2981227,0	2625862,7	7704,1	227,3	107,8	1078,3
2018	3560302,0	3045201,9	10742,0	639,1	107,0	692,0
2019	3977198,0	3019383,1	12474,9	556,5	42,5	1147,0
2020	4222026,0	3236369,1	12297,7	279,5	125,3	1704,2

Source: formed by the authors based on [8]

X_2 – the amount of innovative activity financing by state budget funds, million UAH;

X_3 – the amount of innovative activity financing by funds of non-resident investors, million UAH;

X_4 – the amount of innovative activity financing by funds of other sources, million UAH.

The obtained model of the dependence of the volume of GDP on the sources of innovative development financing is:

$$Y_1 = -155076{,}63 + 129{,}43 \times X_1 + 4113{,}36 \times X_2 + 137{,}63 \times X_3 - 80{,}36 \times X_4.$$

However, the results of building a model of the dependence of the GDP on the sources of financing of innovative development (Table 7) and the analysis of the parameters of the model's significance showed that indicators X_3 (the amount of innovative activity financing by funds of non-resident investors) and X_4 (the amount of innovative activity financing by

Table 7 – Results of building a model of the dependence of the volume of GDP on the sources of financing of innovative development

	Coef-ficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95,0%	Upper 95%
Intercept	-155077	351097,33	-0,44169	0,664624	-899370	589216,4	-899370	589216,4
X_1	129,4301	36,254145	3,570076	0,002556	52,57471	206,2854	52,57471	206,2854
X_2	4113,359	1045,8145	3,933163	0,001188	1896,331	6330,387	1896,331	6330,387
X_3	137,6274	261,4811	0,526338	0,605873	-416,688	691,9426	-416,688	691,9426
X_4	-80,3565	104,25083	-0,7708	0,452059	-301,358	140,6454	-301,358	140,6454

Source: calculated by the authors

Table 8 – Results of the adjusted modeldependence of the volume of GDP on the sources innovative development financing

Residuals:					
	Min.	**1Q**	**Median**	**3Q**	**Max**
	-1093276	-245431	-86042	237573	1730246
Coefficients:					
	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**	
(Intercept)	-155735.50	281100.36	-0.554	0.586382	
X_1	125.86	34.83	3.613	0.001987	**
X_2	3934.68	993.27	3.961	0.000915	***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
Residual standard error: 682000 on 18 degrees of freedom					
Multiple R-squared: 0.7395, Adjusted R-squared: 0.7105					
F-statistic: 25.54 on 2 and 18 DF, p-value: 5.534e-06					

Source: calculated by the authors

funds of other sources) are not significant, so it was decided to remove these variables from the model, and the results presented in Table 8.

The resulting model in this case will look like this:

$$Y_1 = -155735{,}5 + 125{,}86 \times X_1 + 3934{,}68 \times X_2.$$

The obtained results show the significance of both indicator X_2 (the amount of innovative activity financing by state budget funds) and indicator X_1 (the amount of innovative activity financing by own funds of enterprises) for increasing the GDP. Moreover, with an increase in the amount of financing of innovative activities at the expense of the innovative activity subjects' own funds by 1 million UAH, the GDP will increase by 125,86 million UAH. With an increase in the amount of financing of innovative activities of business entities at the expense of state budget funds by 1 million UAH, GDP will increase by 3934,68 million UAH. The obtained results show greater importance of financing innovative activities from the state budget of Ukraine, which can be explained by the greater responsibility of enterprises and the need to submit reports to state authorities related to the use of provided budget funds.

The formation of a model of the dependence of the volume of enterprises' products sold on the sources of innovative development financing:

$$Y_2 = f(X_1; X_2; X_3; X_4),$$

where Y_2 is the volume of sold products (goods, services) of enterprises, million UAH.

Table 9 – Results of building a model of the dependence of the volume of enterprises' products sold on the innovative development funding sources

Residuals:					
	Min.	**1Q**	**Median**	**3Q**	**Max**
	-836983	-194685	-99717	76020	1151411
Coefficients:					
	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**	
(Intercept)	-21568.79	212060.79	-0.102	0.920111	
X_1	106.33	26.28	4.046	0.000757	***
X_2	2977.76	749.31	3.974	0.000890	***
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
Residual standard error: 514500 on 18 degrees of freedom					
Multiple R-squared: 0.7607, Adjusted R-squared: 0.7341					
F-statistic: 28.61 on 2 and 18 DF, p-value: 2.57e-06					

Source: calculated by the authors

The built model also showed the insignificance of factors X_3 and X_4, which were removed from the model.

So, the resulting model of the dependence of the volume of sold products (goods, services) of enterprises on the sources of funding for innovative development looks like this:

$$Y_2 = -21568{,}8 + 106{,}33 \times X_1 + 2977{,}76 \times X_2.$$

Thus, the modeling results show that if the amount of financing of innovative activity at the expense of the subjects' own funds is increased by 1 million UAH, the volume of sold products (goods, services) of enterprises will increase by 106,33 million UAH. With an increase in the volume of financing of innovative activities of business entities at the expense of the state budget funds by 1 million UAH, the volume of products sold (goods, services) of enterprises will increase by 2977,76 million UAH.

Conclusions. It was determined that the main obstacle to increasing the innovative development of Ukrainian enterprises is insufficient funding. Therefore, there is a need for practical substantiation and the formation of a holistic view of financing the innovative development of business entities, which will ensure recovery in the war and post-war periods, renewal of the material base, growth of production volumes, increase in business activity, production of competitive products on world markets. The results of the research showed the greater importance of financing enterprises from the state budget for increasing the innovative activities effectiveness, which can be determined by the motivation of enterprises in connection with the state's interest in increasing the innovativeness and competitiveness of enterprises, as well as the increased responsibility of enterprises and the need to submit reports to state authorities related to the use of provided budget funds.

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