https://doi.org/ 10.7251/EMC2101094V
UDK: 336.781.5:334.012.63/.64(477)
Datum prijema rada: 28. decembar 2020.
Submission Date: December 28, 2020
Datum prihvatanja rada: 14. jun 2021.
Acceptance Date: June 14, 2021
Časopis za ekonomiju i tržišne komunikacije
Economy and Market Communication Review
Godina/Vol. **XI** • Br./No. **I**
str./pp. 94-108

ORIGINALNI NAUČNI RAD / ORIGINAL SCIENTIFIC PAPER

RELATIONSHIP BETWEEN FINANCING AND EFFICIENCY OF INNOVATIVE ACTIVITIES OF INDUSTRIAL ENTERPRISES: EVIDENCE FROM UKRAINE

Oleh Vysochan | Doctor of Science in Economics; Professor; Lviv Polytechnic National University, Bandery St. 12, Lviv, Ukraine; oleh.s.vysochan@lpnu.ua

Andriy Boychuk | Ph. D. in Economics; Assistant; Lviv Polytechnic National University, Bandery St. 12, Lviv, Ukraine; andriy.b.boychuk@lpnu.ua

Vasyl Hyk | Ph. D. in Economics; Associated Professor; Lviv Polytechnic National University, Bandery St. 12, Lviv, Ukraine; vasyl.v.hyk@lpnu.ua

Abstract: *The article focuses on the study of the closeness of the relationship obtained from different sources and used in different areas, finance, with the effectiveness of innovation, measured by the number of developed innovative products and the number of introduced new technological processes. The input information was the data of industrial enterprises of Ukraine for the period 2015-2019, summarized in statistical reporting and presented on the official resources of the State Statistics Service. To accomplish these objectives, the methods of correlation-regression analysis and analysis of the dynamics and structure of statistical indicators of innovation of industrial enterprises of Ukraine were used. Possible causes of crisis phenomena of innovative activity of Ukrainian enterprises that hinder the economic development of the national economy are discussed. The basis for further research of complex and individual influence of factors on development of innovative activity of the enterprises of various branches of economy is provided.*

Keywords: *innovation activity; innovation financing; innovative products; new technological process; correlation-regression analysis.*

The JEL classification: *C21, O32*

INTRODUCTION

Ukraine has always positioned itself as a country with high scientific potential. However, during the years of independence, the state has not succeeded to effectively establish macro-innovation policy, promote the development of science at a high level and transform the innovative results of scientists into the latest technologies and developments. For a long time, even methodological issues, such as measuring of innovation activity, have not been remained unresolved in Ukraine.

Despite the rather high scientific potential of Ukraine, which was largely formed during the Soviet Union, the crisis in the country in the 90s (decline in production, rapid inflation, mass unemployment after the collapse of the USSR), then in 2008-2009 (exports, reduced reliability of the banking system due to the global financial crisis), later in 2014-2016 (weak trade policy, unfavorable economic conditions, the development of inflation against the background of hostilities in the east and the annexation of Crimea) and finally in 2020 (GDP decline, unemployment growth caused by the COVID-19 pandemic) have led to a loss of demand for innovative products in the domestic market, due to falling overall investment, rising mutual debt and reorientation of economic activity from the real sector to the sector of rapid return on investment, the nature of government economic policy to support the innovative development of production, the high cost of credit resources of banks and a number of other important factors.

It has long been recognized that innovation is an important factor in determining productivity, competitiveness and economic growth (Dastory, L., 2018). Less access to capital leads to companies from transition economies (including Ukraine) being less productive and less innovative than companies from industrialized countries (Gorodnichenko, Y. & Schnitzer, M., 2010).

Many economists, starting with J. Schumpeter, suggested that it is difficult to finance innovation in a free competitive market, arguing that knowledge about the production of new goods and services as a result of innovative investments cannot be kept secret, which will inevitably lead to impossibility of appropriation income by a firm that makes such investments (Hall, B. H., 2008).

Financial markets play a key role in establishing the dynamics of innovation. Financial intermediaries – such as banks, venture capitalists, private investment companies – redirect capital from where it is stored to where it is needed. The pace of change in innovation depends on both the provision of capital and the mechanisms of proper management (Nicholas, T., 2011).

(Nikonova, Ya. I., 2016), analyzing the dependence of GDP per capita on the level of innovative development, as well as global competitiveness on the level of innovative development in the world, notes that the financing of innovation and innovative development is the basis of economic growth. Proving based on correlation-regression analysis the relationship between the costs of financing the activities of industrial enterprises and the GDP of Ukraine, (Marynenko, N., Fedyshyn, I., Garmatiy, N. & Kramar, I., 2019) conclude that the positive dynamics of increasing the total amount of expenditures to finance innovative activities of industrial enterprises will lead to positive dynamics of Ukraine's GDP, which, at the same time, will improve other economic indicators.

The objective of the study was to establish the closeness of the relationship between the volume of funding for innovation in Ukraine (including in terms of its sources: own funds, state budget, etc.) and its results – the number of developed innovative products and the number of new technological processes, as well as establishing the dependence of the structural distribution of funding sources on the use of funds.

With regards to the organization of the paper, after the brief introduction we provide summarized literature review on the efficiency of innovative activities of industrial enterprises. Furthermore, we proceed to the explanation of the methodology

and the data used to conduct the empirical research. Results section outlines the most important findings together with the interpretation while the paper ends by the concluding remarks section.

LITERATURE REVIEW

In recent years, the amount of literature on innovation financing has been growing rapidly. It focuses on several key themes: 1) the existence of clear evidence of significant limiting factors in the financing of research and development firms, as well as innovation; 2) capital structure, which plays a significant role in the effectiveness of innovation: the priority of bank financing for large companies that have collateral and significant amounts of financing in public markets, but with a set of additional agency costs; 3) growing interest in researching the problems of multi-stage financing in startups, as well as optimizing contracts and policies to stimulate innovation (Kerr, W.R. & Nanda, R., 2014).

Financial systems can influence innovation, both by performing their inherent functions and through various components of their structure, such as markets, institutions and instruments. At the same time, technological innovations can define financial systems, both indirectly, as their specificity requires the emergence of alternative financing solutions, and directly, as technological evolution changes the performance of financial systems and transforms their structure (Deligia, E., 2006).

(King, R.G. & Levine, R., 1993) conducted an empirical study of the relationship between a number of indicators of financial development, entrepreneurship and economic growth. Among other things, they found that more developed financial systems increase the likelihood of successful innovation and thus accelerate economic growth. (Meierrieks, D., 2014) examines the impact of financial development on innovation, using data from 51 countries for the period 1993-2008. There is a direct relationship between the level of financial development and innovation, which indicates the need to take this factor into account when determining national innovation potential.

Firms that do not have barriers to accessing financial resources are often more innovative (Alsharkas, A., 2014). The size of the financial sector and the activities of banks and the stock market are positively related to the number of patent applications filed in East Asian countries (Tee, L.-T., Low, S.-W., Kew, S.-R. & Ghazali, N.A., 2014).

An inverse relationship could be observed. For low-income countries, it is important to use cheap production methods and support technological innovation. Through financial development, economic growth and productivity gains are achieved in the medium term (Dabla-Norris, E., Kersting, E. & Verdier, G.). Encouraging research and development in small firms that have a high, untapped return on innovation can have positive consequences for the growth and development of banks and other financial institutions (Sharma, S., 2007).

At the same time, studies by (Loukil, K., 2020) show the presence of nonlinear effects in the relationship between financial development and innovation. Since the implementation of financial reforms is insufficient to promote innovative development, it is important to create appropriate economic and technological conditions. Moreover, while the development of equity markets stimulates innovation, the development of the credit market hinders innovation, as demonstrated by the empirical data

of 34 developed and developing countries (Hsu, P.-H., Tian, X. & Xu, Y., 2014). The theoretical basis of the nonlinear relationship between finance and innovation is also substantiated by (Law, S.H., Lee, W.C. & Singh, N., 2018).

Innovation activity is influenced not only by the amount of funding, but also by the type of finance received, which is related to four basic characteristics of innovation: uncertainty – funding is characterized by high risks; long-term nature and cumulativeness – funding should be long-term; collectivity – involves several forms of finance from various public and private sources (Mazzucato, M. and Semieniuk, G., 2017). The development of different forms of funding can stimulate investment in research and development in different ways (Maskus, K.E., Neumann, R. & Seidel, T., 2012).

Thus, modern scientific research does not provide a clear answer to the question of the existence and closeness of the relationship between the results of innovation and the amount and structure of its funding. The purpose of our study is achieved by confirming (or refuting) three hypotheses:

H1: there is a direct close connection between the amount of attracted funding for innovation activities (innovation costs) for industrial enterprises of Ukraine and the number of innovative types of products mastered by them.

H2: there is a direct close connection between the amount of attracted funding for innovation activities (innovation costs) for industrial enterprises of Ukraine and the number of new technological processes introduced by them.

H3: there is a high level of determinedness of the resulting indicators of innovation (the number of developed by Ukrainian enterprises of innovative products, the number of new technological processes implemented by industrial enterprises of Ukraine) structural factors of financing innovation in terms of sources and costs of innovation in terms of spending.

DATA AND METHODOLOGY

To study the closeness of the relationship between indicators of innovation financing (innovation costs) and performance indicators of innovation, which selected the number of developed innovative products and the number of introduced new technological processes, used the tools of correlation and regression analysis.

Regression analysis provides information about the relationship of the original variable with one or more independent variables insofar as such information is contained in the database. The relevance and accuracy of the conclusions depend on the data used: data that are not representative or improperly collected can lead to inadequate and erroneous conclusions (Gunst, R.F. & Mason, R.L., 1980). In the presented study we used data collected by the State Statistics Service of Ukraine and contained in the public domain on the official website of the organization www.ukrstat.gov.ua. At the same time, we assume the presence of errors in the results obtained related to the collection and processing of data used by statistical authorities.

To assess the current state and dynamics of changes in the effectiveness of innovation during the period from 2015 to 2019 in Ukraine, we will analyze them in relation to other macroeconomic indicators: the number and share of industrial enterprises that have implemented innovations; the share of sold products in the volume of industrial; composition and structure of innovation funding sources; composition and structure of the use of borrowed funds (costs of innovation).

All calculations and their visualization were performed using the "Analysis Package" tool of the "Data Analysis" add-on of the Microsoft Excel application package.

From those given in table 1 and fig. 1 indicators we see that although during 2015-2019 the number of industrial enterprises of Ukraine that implemented innovations increased in absolute terms from 723 to 782 units, their share in the total number of industrial enterprises for the analyzed period decreased from 15,2 % to 13,8 %, which is extremely low compared to developed countries, where the share of industrial enterprises that implement innovations is 60-70 %.

Table 1. The main indicators of innovative activity of the industry of Ukraine

Indexes / Years	Number of innovatively active industrial enterprises, units	The share of innovatively active industrial enterprises, %	The share of innovative industrial products in the total sales of industrial enterprises, %	Innovative products mastered in the reporting year, units	New technical processes introduced in the reporting year, units	
					Total	Of these: low-waste, resource-saving
2015	723	15,2	1,4	3136	1217	458
2016	735	16,6	-*	4139	3489	748
2017	759	14,3	0,7	2387	1831	611
2018	777	15,6	0,8	3843	2002	926
2019	782	13.8	1,3	2148	2318	857

* The calculation of the indicator in this period was not carried out

Source: State Statistics Service of Ukraine (Economic statistics, 2020)

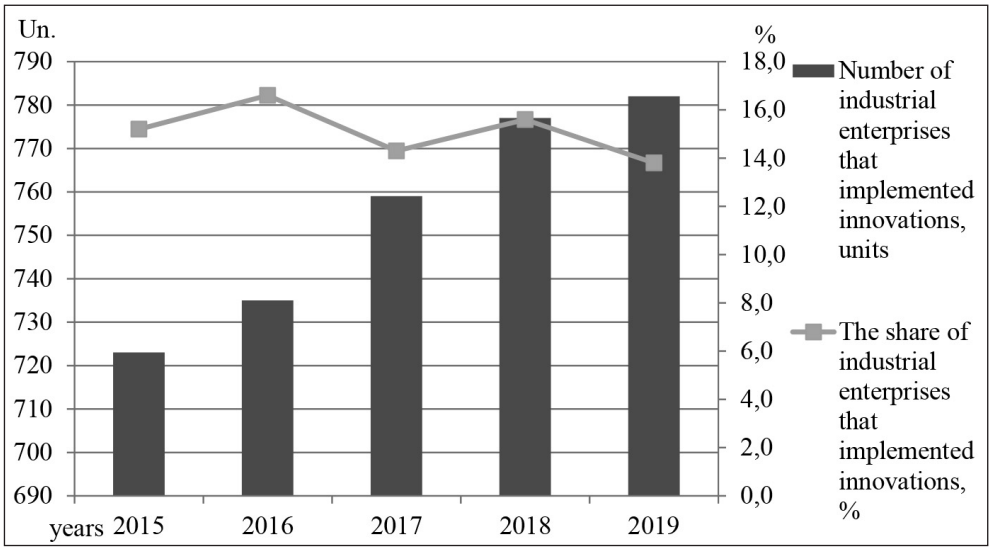

Figure 1. Dynamics of the number of industrial enterprises that implemented innovations and their share in 2015-2019

Source: formed by the authors on the basis of official statistics (Economic statistics, 2020)

Analysis of the number of developed innovative products and introduced new technological processes by industrial enterprises of Ukraine, including low-waste, resource-saving (table 1 and fig. 2) showed that during the analyzed period the number of developed innovative products decreased by 988 units, or 31,51 %. At the same time, the number of introduced new technological processes for the same period has almost doubled, namely from 1217 to 2148 units. The result of the positive dynamics of some analyzed indicators during 2015-2019 is a gradual economic growth after the crisis of 2013-2014.

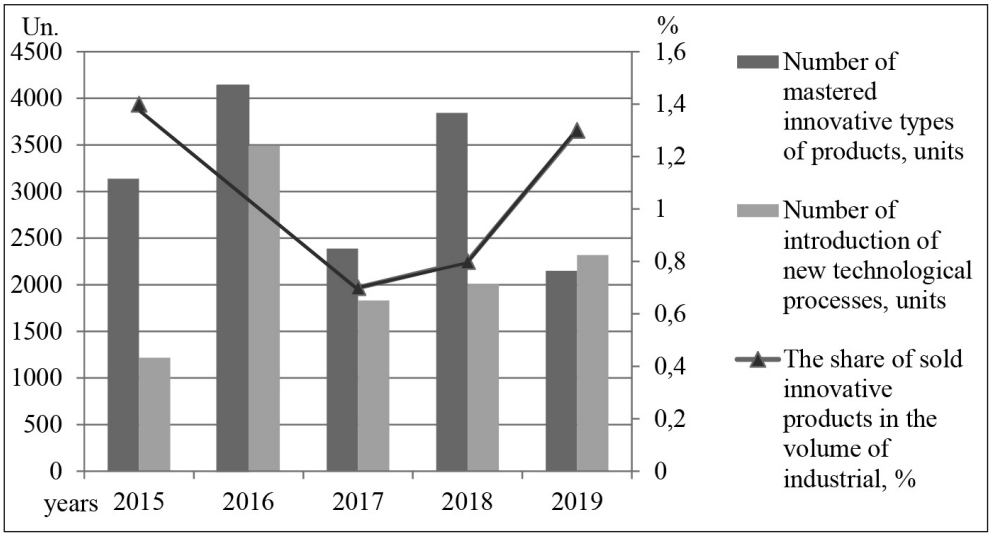

Figure 2. Dynamics of implementation of new technological processes and innovative types of products and their share in the volume of industrial for 2015-2019

Source: formed by the authors on the basis of official statistics (Economic statistics, 2020)

The result of the gradual formation and consolidation in Ukraine of the economic model, which is based, as a rule, on low-tech industries and systems, was the deepening of the trend of dominance of industries with low knowledge intensity in the industry of the state. This, at the same time, was reflected in the share of sold innovative products in the volume of industrial, which, as can be seen from table 1 and fig. 3, during the analyzed period ranged from 0,7 to 1,4 percent.

Analyzing the dynamics of the indicators listed in table 1 and fig. 3, we observe that the periods of decrease and increase of these indicators did not always coincide with each other, sometimes showing even opposite tendencies. Therefore, we come to the conclusion that innovation activity at industrial enterprises of Ukraine is carried out chaotically, unstructured, the dynamics of innovation processes is unstable, and in many cases irrational. This is confirmed by the fact that over a short period of time, certain indicators of innovation activity in Ukrainian industry show oppositely different development trends.

According to the current legislation of Ukraine, innovative development in the country is provided through funding from various sources. These include scholars and Ukrainian legislation, including own funds, state and local budgets, extra-budgetary

funds, funds of Ukrainian and foreign investors, as well as credit funds and funds from other sources. The Law of Ukraine "On Scientific and Scientific-Technical Activity" states that one of the main levers of state policy in the field of scientific and scientific-technical activity is budget funding. And article 34 of this Law states that the state must provide budget funding for scientific and scientific-technical activities, in addition to defense expenditures, in the amount of not less than 1,7 % of Ukraine's GDP. However, despite the legislative regulation of the financing of scientific and scientific-technical activities, the established norms of budget financing of these areas are not observed. It should be noted that, according to experts, the level of R&D funding in Ukraine in recent years has come very close to the level of Soviet spending in the early 1950s. Moreover, the annual actual needs for scientific, technical and innovative activities in Ukraine are met by not more than 16 %.

Thus, the main source of funding for innovation in Ukrainian industry remains the own funds of enterprises. Their superiority among other sources of financing of innovation is due to the insufficiently clear and overly complex process of attracting financial resources due to the unfavorable investment climate and underdeveloped venture financing of innovation. The distribution of the volume of financing of innovative activity in the industry of Ukraine by sources is given in table 2 and graphically shown in fig. 3.

Table 2. Distribution of the volume of financing of innovative activity in the industry of Ukraine by sources for 2015-2019

Source financing / Years		2015	2016	2017	2018	2019
Total funding	UAH million	13813,7	23229,5	9117,5	12180,1	14220,9
	%	100	100	100	100	100
At their own expense	UAH million	13427,0	22036,0	7704,1	10742,0	12474,9
	%	97,20	94,83	84,50	88,19	87,72
At the expense of the state budget	UAH million	55,1	179,0	227,3	639,1	556,5
	%	0,41	0,80	2,50	5,25	3,91
At the expense of funds foreign investors	UAH million	58,6	23,4	107,8	107,0	42,5
	%	0,41	0,1	1,20	0,88	0,30
At the expense of funds other sources	UAH million	273,0	991,1	1078,3	692,0	1147,0
	%	1,98	4,27	11,80	5,68	8,07

Source: formed by the authors on the basis of official statistics (Economic statistics, 2020)

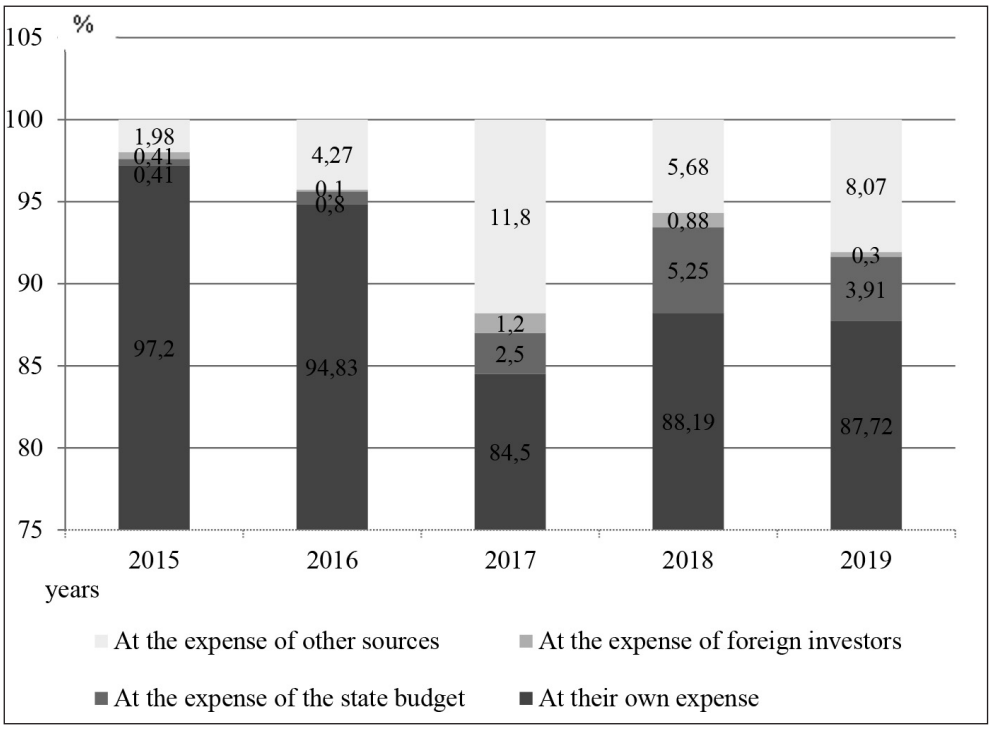

Figure 3. Dynamics of the structure of financing innovation by sources for 2015-2019

Source: formed by the authors on the basis of official statistics (Economic statistics, 2020)

Analyzing the indicators given in table 2 and fig. 4, we see that the share of own funds in the total funding of innovation activities at industrial enterprises of Ukraine fluctuated during 2015-2019 in the range of 84-98 %.

The situation with budget financing of innovation activity in the national industry remains extremely difficult. During the analyzed period, the share of the state budget in the total funding of innovations at industrial enterprises of Ukraine did not exceed 5,25 % (2018). This is much less than in the developed world, where government spending on innovation is 7-15 % of the total. The exception is Japan, where the vast majority of investment in innovation (about 97 %) is provided by industrial companies (Babinska, S., Boychuk, A., 2020).

The next largest source of funding for innovation in Ukraine is the funds of foreign investors. However, the share of this source of funding still remains insignificant. The lowest level of foreign investment in national industry innovation was observed in 2016 and amounted to 23,4 UAH million, or 0,1% of total funding. In all other years of the analyzed period, the share of financing of innovations in the national industry at the expense of foreign investors ranged from 0,4 % to 1,2 %.

The results of the analysis show that the financing of innovation activity in the industry of Ukraine is carried out at an extremely low level. The main part of this financing is the own funds of enterprises.

The results of the study on the volume and share of costs of Ukrainian industrial enterprises in the areas of innovation are given in table 3 and fig. 4.

Table 3. Distribution of total expenditures by areas of innovation for 2015-2019

Costs \ Years		2015	2016	2017	2018	2019
Total costs	UAH million	13813,7	23229,5	9117,5	12180,1	14220,9
	%	100	100	100	100	100
Including by areas:						
Research and development	UAH million	2039,5	2457,9	2169,8	3208,08	2918,9
	%	14,8	10,6	23,8	26,3	20,5
Acquisition of new technologies (other external knowledge)	UAH million	84,9	64,2	21,8	46,1	37,5
	%	0,6	0,3	0,2	0,4	0,3
Purchase of machinery, equipment and software	UAH million	11141,3	19829,0	5898,8	8291,3	10185,1
	%	80,6	85,3	64,7	68,1	71,6
Other expenses	UAH million	548,0	878,4	1027,1	633,9	1079,4
	%	4	3,8	11,3	5,2	7,6

Source: formed by the authors on the basis of official statistics (Economic statistics, 2020)

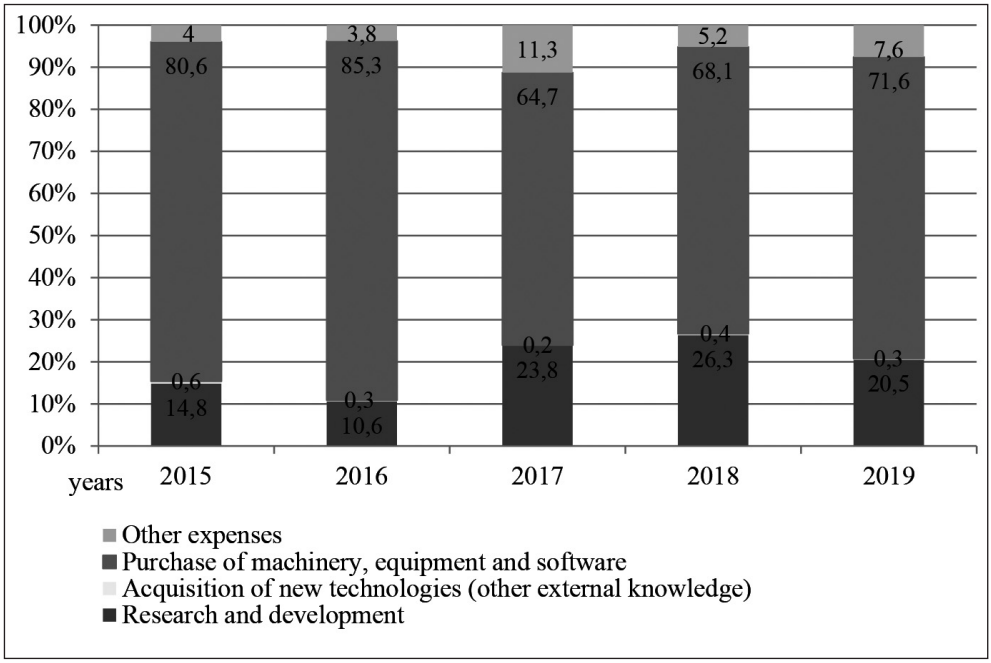

Figure 4. The structure of total expenditures by areas of innovation for 2015-2019

Source: formed by the authors on the basis of official statistics (Economic statistics, 2020)

As can be seen from table 3, the largest share in the total expenditures in the areas of innovation of national industrial enterprises are the purchase of machinery, equipment and software. During the analyzed period, it never fell below 64 %, moreover, there was a tendency to increase this indicator. Thus, if in 2017 the share of costs for the purchase of machinery, equipment and software was 64,2 % of the

total cost of innovation in Ukrainian industry, in 2019 it increased to 71,6 %. In 2015 and 2016, this figure was a record 80,6 % and 85,3 %, respectively, in the total cost of innovation of Ukrainian industrial enterprises.

At the same time, the costs of industrialists for research and development for the analyzed period are much lower than their costs for the purchase of machinery, equipment and software. Thus, the share of research and development costs in the industry of Ukraine for the analyzed period ranged from 10-27 %, which is extremely insufficient for the development of innovation.

The costs of industrial enterprises for the acquisition of new technologies (other external knowledge) were even lower. These costs include, but are not limited to, the acquisition of exclusive property rights to inventions, utility models, industrial designs, licenses, and license agreements for the use of such facilities. The share of such expenditures was the smallest in the structure of the total expenditures on innovations in the national industry and showed a decreasing trend. If in 2015 the share of expenditures for the acquisition of new technologies (other external knowledge) was 0,6 %, in 2019 it decreased by half – to 0,3 %.

The level of innovation activity of industrial enterprises is related to the size of the enterprise. More than two-thirds of enterprises that spent on innovation in industry had more than 1,000 employees. If we take into account enterprises engaged in innovation, with more than 500 employees, their share in the total number of industrial enterprises that spent money on innovation exceeds 85 %. This is explained by the fact that innovations in the national industry of Ukraine are engaged mainly in large, economically strong enterprises that have sufficient financial, intellectual and human resources.

EMPIRICAL RESULTS

The use of correlation-regression analysis allowed to qualitatively assess the statistical relationship between a set of factors (grouped by source of funding and direction of use of funding) and the resulting indicators – the number of developed innovative products and the number of implemented technological processes (table 4).

Table 4. The results of regression analysis of the relationship between the effectiveness of innovation and innovation financing in Ukraine for the period 2015-2019

Influence factor, UAH million	The resulting indicator is the number of developed innovative types of products (IP), units			The resulting indicator is the number of implemented new technological processes (TP), units		
	Coefficient of determination (R-square)	Y-section	Variable X1	Coefficient of determination (R-square)	Y-section	Variable X1
Total funding (TF)	0,386	1638,5	0,103	0,658	298,18	0,129
Own funding (OF)	0,409	1748,3	0,104	0,573	598,73	0,118
Financing from the state budget (FB)	0,008	3233,9	-0,312	0,009	2068,76	0,310
Financing at the expense of foreign investors (FI)	0,027	3384,0	-3,734	0,331	3028,70	-12,633

Funding from other sources (FS)	0,120	3833,9	-0,841	0,365	992,32	1,410
Research and development (RD) costs	0,029	2366,3	0,299	0,069	1030,84	0,446
Costs for acquisition of new technologies (other external knowledge) (NT)	0,279	2169,5	18,882	0,006	2303,25	-2,590
Costs for the purchase of machinery, equipment and software (ME)	0,393	1987,0	0,103	0,585	829,51	0,121
Other costs of innovation activity (IA)	0,348	4953,3	-2,187	0,181	907,70	1,516

Source: calculated by the authors on the basis of the data summarized in table 1, 2 and 3 using the tools of correlation and regression analysis

The unadjusted multiple regression coefficient estimates the proportion of variation in the result due to the factors presented in the regression equation in the total variation of the result. The study showed a moderate relationship between the amount of funding (innovation costs) and the number of developed innovative products (share of variation – 38,6 %), as well as a noticeable but weak correlation between this factor and the number of new technological processes (the share of variation is 65,8 %). The closest connection with the resulting indicators in the structure of funding sources have their own funds: 40,9 % of the variation in the number of developed innovative products is explained by the variation of this factor variable; for the resulting indicator of the number of introduced new technological processes, this impact was 57,3 %. The closest connection with the resulting indicators in the structure of costs for innovation is observed in the indicator of costs for the purchase of machinery, equipment and software: 39,3 % for IP and 58,5 % for TP.

To assess the significance or significance of the value of the correlation coefficient by the Student's t-test, we put forward the null hypothesis: the correlation coefficient of the general population is 0, and the studied factor does not affect the performance indicator. The critical value (t_{cr}) In the set of Student's t-distribution coefficients at the level of significance $\alpha = 0{,}05$ and the number of degrees of freedom $df = 3$ for the bilateral critical region is 2,353. Comparing the calculated value of the t-test (1,37 to assess the impact on the indicator of IP; 2,4 to assess the impact on the indicator of TP) with the critical, we observe the lack of statistical significance of the coefficient in the regression equation with the resulting indicator of the number of developed innovative products, the presence of statistical significance when changing the resulting indicator on the number of introduced new technological processes. A similar analysis for the structural elements of funding sources and areas of expenditure showed their statistical insignificance of their correlation (the largest calculated value of the t-test is 2,01 for the indicator of the amount of funding from own funds). Thus, the analysis and forecast

can be based only on a certain reliability of the coefficients of the regression equation to describe the relationship between TP and TF.

This is also confirmed by the probability of random values of the regression equation: the acceptable level of α is 0,05, while its value for individual components of the indicator of funding and innovation costs reaches 0,88. This allows us to consider the decomposition of these indicators as uninformative to establish the influence of factors on the result.

The visual representation of the correlation field and the constructed trend line on regression models of interdependence of factors (financing and costs of innovations) and indicators of efficiency of innovative activity of industrial enterprises of Ukraine are shown in fig. 5 and fig. 6.

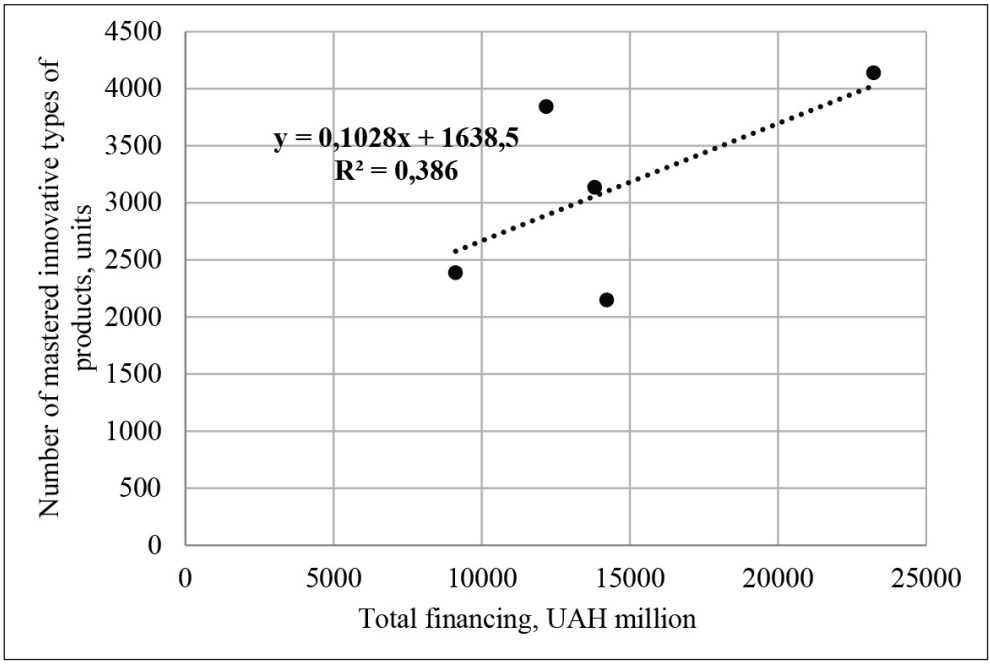

Figure 5. The relationship between the number of developed innovative products and funding in Ukraine in 2015-2019

Source: constructed by the authors on the basis of the data summarized in table 1, 2 using the tools of correlation and regression analysis

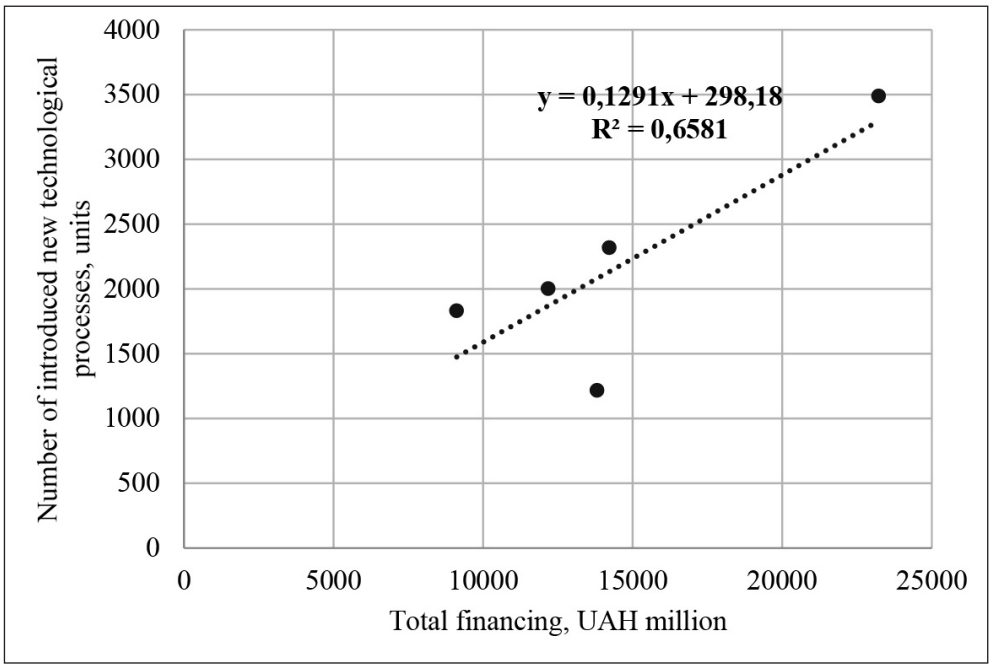

Figure 6. The relationship of the number of introduced new technological processes with the amount of funding in Ukraine in 2015-2019

Source: constructed by the authors on the basis of the data summarized in table 1, 2 using the tools of correlation and regression analysis

The problem of inadequate level of innovation activity in the national industry and low level of innovation activity of Ukrainian industrial enterprises has a systemic character and is mainly due to the general principles of organization of socio-economic activity of Ukraine. The country has not defined strategic goals and objectives of innovative development, has not implemented long-term and medium-term forecasting and planning of socio-economic development, as provided for in developed countries and EU countries. The system of competitive financing as the main mechanism of financing science and innovation has been lost.

The legislative framework, which has undergone significant changes in recent years, has not contributed to the development of innovative activity in the national industry in particular and in Ukraine in general. Legislation in the field of science and technology, which was mainly developed in the 90s of last century, provided the legal basis for the effective development of Ukrainian science and economy in the future, as evidenced by indicators of innovation in national industry, given in table 1-3 and fig. 1-4. At the same time, the innovative activity of industrial enterprises began to decline during the previous decade, mainly due to the underdevelopment of the intellectual property market in Ukraine, low implementation rate of applied developments, as well as unjustified and economically impractical changes to existing legislation in innovation and research (Babinska, S., Boychuk, A., 2020).

CONCLUSION

The study concludes that there is a low level of direct relationship between funding indicators (as well as the cost of innovation) and the number of developed innovative products, as well as the average closeness of the relationship between innovation funding and the number of new technological processes in Ukraine. There is also a low level of determinedness of the resulting indicators in the models by factors of individual sources of funding and areas of use of innovation costs. Thus *H1* was not confirmed, *H2* was partially confirmed, *H3* was not confirmed. The authors suggest, this is due to three main reasons: 1) the risk of innovation; 2) the duration of the life cycle of innovation development 3) the fragmentary financing of innovation projects, which is often manifested in the absence of effective methods for determining promising innovation developments. Also, the assumption about the direct relationship between the results of innovation and the use of borrowed funds in the national economy of Ukraine has not been confirmed. The structural distribution of funding sources and areas of its use does not have a significant impact on the number of developed innovative products and introduced new technological processes in Ukraine over the past 5 years. The least determined for the resulting indicators of innovation in Ukraine is the factor of financing from the state budget, which may indicate both the shortcomings of the mechanism of budget financing of innovation in the country, which is not result-oriented, and the use of funds, which mainly relate to high-risk stage of research in the structure of the innovation cycle.

The critical state of the Ukrainian scientific, scientific-technical and innovation sphere is largely due to the lack of an effective system of public administration of science and innovation, which would responsibly defend compliance with legislation and modern needs of the national innovation system, ensure its interaction with production, coordinate research and developments. Ensuring the competitiveness and high level of innovation of national industry through the activation of scientific, technical and technological potential is one of the most important strategic goals that Ukraine sets for itself in modern conditions.

REFERENCES

Alsharkas, A. (2014). Firm size, competition, financing and innovation. *International Journal of Management and Economics*(44), pp. 51-73. doi:10.1515/ijme-2015-0009.

Babinska, S., Boychuk, A. (2020). Innovative activity as a key factor of the development of industry in Ukraine. *Modern Economics*(19), pp. 14-19. doi:10.31521/modecon.V19(2020)-02.

Dabla-Norris, E., Kersting, E. & Verdier, G. (n.d.). *Firm productivity, innovation and financial development* (IMF Working Paper, WP/10/49 ed.). International Monetary Fund.

Dastory, L. (2018). *Financing on innovation in SMEs.* Stockholm, Sweden: Licentiate Thesis in Economics.

Deligia, E. (2006). Innovation and finance: The theoretical links. *Economia, Societa e Istituzioni*(XVIII-1).

Economic statistics. (2020). Retrieved December 19, 2020, from Science, technology and innovation: http://www.ukrstat.gov.ua/operativ/menu/menu_u/ni.htm.

Gorodnichenko, Y. & Schnitzer, M. (2010). *Financial constraints and innovation: Why poor countries don't catch up* (Vol. 15792). Cambridge, MA: NBER Working Paper.

Gunst, R.F. & Mason, R.L. (1980). *Regression analysis and its application: A data-oriented approach.* New York, USA: Marcel Dekker, Inc.

Hall, B. H. (2008). The financing of innovation, in Scott Shane, (ed.). In *Handbook of Technology and Innovation Management* (pp. 409-430). England: A John Wiley and Sons, Ltd.

Hsu, P.-H., Tian, X. & Xu, Y. (2014). Financial development and innovation: Cross country evidence. *Journal of Financial Economics, 112-1*, pp. 116-135. doi:10.1016/j.jfineco.2013.12.002.

Kerr, W.R. & Nanda, R. (2014). *Financing innovation* (Vol. 20676). Cambridge, MA.: NBER Working Paper.

King, R.G. & Levine, R. (1993). Finance, entrepreneurship and growth: Theory and evidence. *Journal of Monetary Economics, 32*(3), pp. 513-542.

Law, S.H., Lee, W.C. & Singh, N. (2018). Revisiting the finance-innovation nexus: Evidence from a non-linear approach. *Journal of Innovation & Knowledge, 3*, pp. 143-153. doi:10.1016/j.jik.2017.02.001.

Loukil, K. (2020). The impact of financial development on innovation activities in emerging and developing countries. *Business and Economic Research, 10*(1), pp. 112-119. doi:10.5296/ber.v10i1.11235.

Marynenko, N., Fedyshyn, I., Garmatiy, N. & Kramar, I. (2019). Financing innovation activity in Ukraine: Realities and perspectives. *Economic Review – Journal of Economics and Business, XVII*(1), pp. 33-46.

Maskus, K.E., Neumann, R. & Seidel, T. (2012). How national and international financial development affect industrial R&D. *European Economic Review, 56*(1), pp. 72-83. doi:10.1016/j.euroecorev.2011.06.002.

Mazzucato, M. and Semieniuk, G. (2017). Public financing of innovation: New questions. *Oxford Review of Economic Policy, 33*(1), pp. 24-48. doi:10.1093/oxrep/grw036.

Meierrieks, D. (2014). Financial development and innovation: Is there evidence of a Schumpeterian finance-innovation nexus? *Annals of Economics and Finance, 15*(2), pp. 343-363.

Nicholas, T. (2011). What drives innovation? *Antitrust Law Journal, 77*(3), pp. 787-809.

Nikonova, Ya. I. (2016). Evaluation of the influence of innovations and their financing on an economic increase in the national economy. *International Research Journal, 53*(1), pp. 53-59. doi:10.18454/IRJ.2016.53.190.

Sharma, S. (2007). *Financial development and innovation in small firms* (The World Bank ed., Vol. 4350). Washington, DC: Policy Research Working Paper.

Tee, L.-T., Low, S.-W., Kew, S.-R. & Ghazali, N.A. (2014). Financial development and innovation activity. *Prague Economic Papers, 2*, pp. 162-180. doi:10.18267/j.pep.478.