

## FINANCIAL PLANNING OF INNOVATIVE ENTREPRENEURS IN THE SYSTEM OF INSTITUTIONAL ENVIRONMENT AND PUBLIC ADMINISTRATION

Kseniia Sieriebriak<sup>1</sup>, Olexander Krasnoshtan<sup>2</sup>, Svitlana Bebko<sup>3</sup>, Anna Kononenko<sup>4</sup>,  
Olha Batrak<sup>5</sup>, Pavlo Dudko<sup>6</sup>, Roman Kozhushko<sup>7</sup>, Olena Palchuk<sup>3\*</sup>

<sup>1</sup>Department of Economics and Entrepreneurship, Volodymyr Dahl East Ukrainian National University, Central Avenue 59-a, 93400 Severodonetsk, Ukraine

<sup>2</sup>Department of Management and Tourism, National Transport University, Omelianovycha-Pavlenka 1, 01010 Kyiv, Ukraine

<sup>3</sup>Department of Smart Economics, Kyiv National University of Technologies and Design, Nemyrovycha-Danchenka 2, 01011 Kyiv, Ukraine

<sup>4</sup>Department of Finance and Business Consulting, Kyiv National University of Technologies and Design, Nemyrovycha-Danchenka 2, 01011 Kyiv, Ukraine

<sup>5</sup>Department of Finance and Investment, Kyiv National University of Technologies and Design, Nemyrovycha-Danchenka 2, 01011 Kyiv, Ukraine

<sup>6</sup>Department of Entrepreneurship and Business, Kyiv National University of Technologies and Design, Nemyrovycha-Danchenka 2, 01011 Kyiv, Ukraine

<sup>7</sup>Department of Management and Smart Innovation, Kyiv National University of Technologies and Design, Nemyrovycha-Danchenka 2, 01011 Kyiv, Ukraine

\*e-mail: palchuk-olena@ukr.net

### Abstract

Innovative entrepreneurship is a key link in the transfer of innovation, which involves the movement of knowledge from the scientific sphere to the economic sphere in order to transform theoretical knowledge into new products and services that will have a positive effect in increasing social welfare. Innovative entrepreneurship functions in conditions of high turbulence of socio-economic processes, in particular changes in the institutional environment and the development of public administration in Ukraine. And there are certain external and internal restrictions in the process of development of innovative entrepreneurship and some of them are associated with inefficient financial management, which does not allow to create appropriate conditions for the intensification of innovative entrepreneurship. Financial planning is a main component of financial management of any business entity, and combines such elements as: analysis of current financial performance, definition of strategic financial objectives of the entity, development and implementation of the plan financial measures, analysis of the results of implementation of selected financial measures and their adjustment. The aim of the article is to study the methodology of financial planning of innovative entrepreneurship in the institutional environment and

public administration, development of an integrated indicator of innovative entrepreneurship effectiveness and forecasting of financial efficiency using methods of economic and mathematical modeling.

To conduct the research, empirical data were obtained from the State Statistics Service of Ukraine. The specified data characterize the innovative entrepreneurial activity, the economic efficiency of innovation for the period from 2015 to 2020. The collected data made it possible to build a forecast that allows to identify possible changes in the financial efficiency of entrepreneurship, in particular, helps to develop alternative measures. A parabolic trend is used for building a predictive model.

The methodology of financial planning of subjects of innovative entrepreneurship in the system of institutional environment and public administration, development of an integrated indicator of effectiveness of innovative entrepreneurship and implementation of financial efficiency forecasting using the built economic and mathematical models was analyzed. Analysis of the integrated performance indicator of innovative entrepreneurship indicates that performance is characterized by significant fluctuations. The

indicators calculated with the help of economic and mathematical models indicate the positive dynamics of the volume of sold innovative products. Also, positive dynamics is observed in revenues from innovation changes. The indicators calculated using economic and mathematical models indicate positive dynamics of the volume of implemented innovative products, which will amount to 1883.35 million € in 2021 and 2560.34 million € in 2022. Positive dynamics are also observed in the income from innovation activity, so the forecast value in 2021 is 1335.08 million €, and in 2022 - 2016.77 million €. According to forecast data, the profitability index of innovative products in 2021 is 2.63, and in 2022 - 3.71.

Assessing the effectiveness of innovation, it is proposed to use an integrated indicator, which was built on the several components. Analysis of the dynamics of the integrated performance indicator for the period 2015 - 2020 reveals significant fluctuations, but since 2019 the effectiveness of innovative entrepreneurship is growing.

**Key words:** *Innovative entrepreneurship, Public administration, Financial planning.*

## 1. Introduction

In the context of significant socio-economic changes associated with the introduction of modern information technology to some extent in all spheres of public life, there is the introduction of the concept of intensifying innovative entrepreneurship as a factor of sustainable development of the national economy and ensuring the competitiveness of individual businesses. Innovative entrepreneurship is a key link in the transfer of innovation, which involves the movement of knowledge from the scientific sphere to the economic sphere in order to transform theoretical knowledge into new products and services that will have a positive effect in increasing social welfare.

However, it should be noted that the process of development of innovative entrepreneurship takes place within certain restrictions of both external and internal origin. Factors that significantly complicate the development of innovative entrepreneurship include the following: relatively low demand for products and services of innovative nature produced by domestic producers, insufficient motivation to innovate among national economic entities, insufficient level of public funding for science and technology, inefficient system venture financing, imperfect institutional environment and more. Based on the above, many obstacles to the development of innovative entrepreneurship are associated with inefficient financial management, which does not allow to create appropriate conditions

for the intensification of innovative entrepreneurship through effective redistribution of capital. An important element of financial management is the process of financial planning, which involves analyzing the current financial situation, forming strategic goals, developing and implementing financial management measures and adjusting them to the next stage of assessing the financial situation.

The aim of the article is to study the methodology of financial planning of innovative entrepreneurship in the institutional environment and public administration, development of an integrated indicator of innovative entrepreneurship effectiveness and forecasting of financial efficiency using methods of economic and mathematical modeling.

## 2. Materials and Methods

The analysis of the scientific literature indicates that many scientific works have been devoted to the study of various aspects of entrepreneurship, in particular, recent attention of scientists is attracted by innovative entrepreneurship and features of its implementation in modern conditions. Baumol [1], in his book explores the characteristics of innovative entrepreneurship, distinguishing between the concept of entrepreneur-innovator and entrepreneur-replicator. He emphasizes the importance of innovative entrepreneurship for economic growth and prosperity. In order to develop a more effective policy, the author proposes the co-optation of innovative entrepreneurship into the generally accepted structure of microeconomics. In their work, Szabo and Herman [2], and Crudu [3], exploring the relationship between entrepreneurship and innovative entrepreneurship, also draws attention to the important role of innovative entrepreneurship in ensuring the modern economic development and growth of EU member states. Authors Khodakivska *et al.*, [4], and Mazur *et al.*, [5], identify models of innovative development of entrepreneurship in different sectors of the economy.

Many works are devoted to the study of the interaction of public policy and innovative entrepreneurship. As an example, Giraudo *et al.*, [6], highlight the "institutional division of labor" between a business entities's access to government-guaranteed bank loan programs and fiscal incentives for venture capital. In their work, the authors also highlight the effect of task segmentation. Vecchi *et al.*, [7], developed a management approach using the methods of induction and deduction, which allows to increase the effectiveness of regional policy aimed at enhancing entrepreneurship in the region. Bradley *et al.*, [8], in their article consider the functioning of innovative entrepreneurship benefits and costs of alternative institutional environments

and targeted government interventions that take place within and between the macro-institutional and micro-political levels.

Some aspects of the institutional environment as a factor of entrepreneurship are studied by some scholars. Henrekson and Stenkula [9], analyze regulatory restrictions on entry and growth in the industry, labor relations regulation, fiscal policy constraints and liquidity. The authors emphasize that the effectiveness and prevalence of entrepreneurship is greatly influenced by the institutional framework set by public policy. Elert and Henrekson [10], explore the institutional structure as a factor in the effectiveness of a joint innovation unit consisting of entrepreneurs, innovators, staff, early and late investors and customers. Wang and Zhou [11], explore institutional constraints and their impact on innovative start-ups. The authors note a clear negative impact of institutional constraints on the functioning of innovative entrepreneurship. Also Amini Sedeh *et al.*, [12], devoted their work to the study of institutional barriers faced by innovative entrepreneurship. They note that the institutional barriers to the development of innovative entrepreneurship include the following institutional cavities: regulatory, which are related to the imperfection of intellectual property rights and the inefficiency of the political system; economic ones, which reflect inefficient fiscal structure and problematic financial instruments; cultural, which are formed due to the negative attitude in society to risks and entrepreneurial activity. Thus, Accordino, [13], devoted his work to the study of certain aspects of fiscal policy as a factor in the development of innovative entrepreneurship and proposed an author's strategy for targeted fiscal policy. The authors Mayovets *et al.*, [14], identified tools for stimulating entrepreneurship, taking into account the impact of various environmental factors.

Some studies also analyze certain aspects of innovative entrepreneurship finance. Thus, Wilson, [15], in his work analyzes the problems of access of innovative enterprises to financial resources in the early stages of operation and possible ways to correct this problem. Ogochukwu, [16], explores the relationship between innovative entrepreneurship and finance, taking into account the national characteristics of Nigeria. According to this study, access to finance and long-term lending determines almost 50% of innovative entrepreneurial activity. However, a significant role in the formation of the deficit of innovative entrepreneurship is played by the low level of education of entrepreneurs and staff, which is not typical for entrepreneurship in Ukraine. In her work, Ugrinovska, [17], analyzes the use of public financial instruments to finance innovative entrepreneurship on

the example of financial practices used in Australia. In particular, the author examines financial instruments in three areas, namely: loan financing instruments that depend on the income of the entity, government subsidies and direct government financial support for innovative entrepreneurship.

Despite the large number of scientific papers devoted to the study of various aspects of innovative entrepreneurship, the problem of financial planning of innovative entrepreneurs remains insufficiently covered in the scientific literature and needs further study. The aim of the article is to study the methodology of financial planning of innovative entrepreneurs in the institutional environment and public administration, development of an integrated indicator of innovative entrepreneurship effectiveness and forecasting of financial efficiency using methods of economic and mathematical modeling.

Financial support is extremely important for any type of business, in particular for innovation, because the commercial success of businesses in the field of innovation largely depends on the ability of the entity to financially support the implementation of an innovative project from development to market. In the conditions of the national economy, entrepreneurs of the innovation sphere face the mismatch of financing and problems of access to financial resources at all stages of the innovation project. Therefore, in order to increase the efficiency of financial support of innovative entrepreneurship, it is advisable to use financial planning tools. The general algorithm of financial planning involves the following stages: determining the current financial condition, forming strategic financial goals, identifying alternative sets of measures, evaluating alternative measures, creating and implementing a plan of financial measures, analyzing the results of implementing selected financial measures and adjusting them.

In the process of analyzing the current financial condition it is not only the analysis of financial indicators that takes place, but also identifying factors that affect the financial condition of businesses. Thus, within the framework of innovative entrepreneurship, a significant factor in the financial well-being of economic entities is the institutional environment within which national entrepreneurs operate. It is the innovation environment that reflects the set of fundamental norms that determine the behavior of members of society in political, legal, economic, social and other spheres of public life. The role of the institutional environment as a factor in the development of innovative entrepreneurship is quite significant in Ukraine, as over the past three decades it has been largely transformed in the

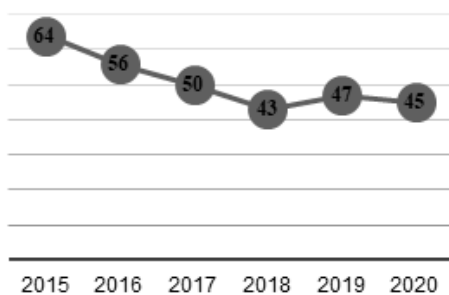
process of transition of the national economy from the command-administrative model to the market. As a result of the specific historical conditions in which the transformation took place, the institutional environment is characterized by a special structure and co-opts three types of institutions, namely: institutions that were formed during the Soviet era; institutions that have been implanted in order to form a market model of the economy; institutions that were formed during the period of transformation of the national economy and its functioning within the market model. Such a system of institutions is complex, has many contradictions and, as a result, negatively affects the development of innovative entrepreneurship due to its low efficiency. Thus, the analysis of one of the most authoritative international rankings - The Global Innovation Index, which provides a comprehensive assessment of the country's innovative development, indicates that there is a positive trend in innovation, because from 2015 to 2020 Ukraine rose in the ranking from 64 to 45th place. The dynamics of the Global Innovation Index for Ukraine for the period from 2015 to 2020 is shown in Figure 1.

However, researching individual sub-indices of the integrated indicator reveals disparities in the development of individual components, for example, "Human Capital and Research" and "Knowledge and Research Results" have a high level of development and create conditions for innovative entrepreneurship, while components "Infrastructure", "Market Indicators" and "Institutions" have a low rating, i.e. they lead to the formation of barriers to the development of innovative entrepreneurship in Ukraine. The dynamics of the sub-indices of the Global Innovation Index for Ukraine for the period from 2015 to 2020 [19], is shown in Figure 2.

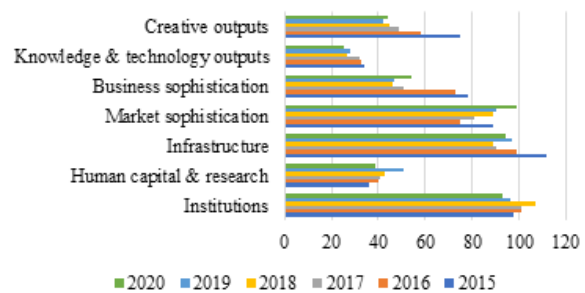
It is the sub-index "Institutions" that characterizes the institutional environment, which is a factor in the development of innovative entrepreneurship in Ukraine. According to the methodology of the

Global Innovation Index, this sub-index includes three components that characterize: the political environment, the regulatory environment and the business environment.

Analyzing the institutional environment within which innovative entrepreneurship operates in Ukraine, we can conclude that the biggest obstacles to innovation are primarily related to the political and business environment, but the low level of regulatory environment also contributes to inhibiting innovation development. The low level of development of regulatory and political institutions leads to a decrease in the quality of the institutional environment in general, as the level of uncertainty increases, which immediately limits the ability of innovative entrepreneurs to plan finances and worsens long-term investment conditions in innovative projects in particular. Thus, the national institutional environment is characterized by a low level of protection of property rights, in particular, the level of protection of intellectual property is extremely low. In the context of innovative entrepreneurship, this leads not only to increased costs to compensate for the shortcomings of the institution, such as legal services, but also to reduce interest in innovative projects in general, because, according to investors, there is a possibility of losing results. The low level of development of the tax institution also leads to an increase in costs, which also leads to an excessive tax burden and a decrease in the level of profitability of investment projects. The institution of solving the problem of insolvency also needs development, as it creates inadequate conditions for the functioning of entrepreneurship, because bankruptcy is a natural element of entrepreneurial activity, especially in the field of innovation. However, the biggest problem in the functioning of the institutional environment in Ukraine is corruption, in particular corruption in public authorities. Corruption as a multidimensional phenomenon, on the one hand, is the result of the functioning of inefficient formal and informal



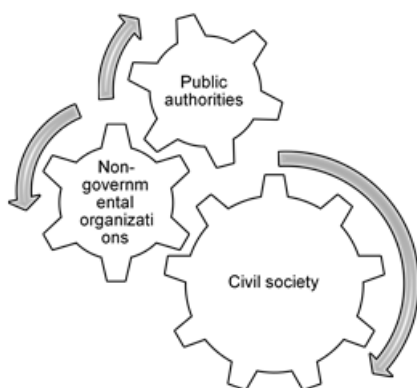
**Figure 1. Dynamics of the Global Innovation Index for Ukraine for 2015-2020**  
 Source: developed by the author according to the reports "The Global Innovation Index" 2015 - 2020 [19]



**Figure 2. Dynamics of sub-indices of the Global Innovation Index for Ukraine for 2015-2020**  
 Source: developed by the author in accordance with the reports of "The Global Innovation Index" 2015 - 2020 [19]

institutions, on the other hand, it is itself an institution that directly exerts pressure and leads to functional deformation of existing institutions. For example, the imperfection of legal norms and the high level of state regulation leads to the formation of a space in which the representative of the government has the opportunity to carry out acts of corruption. As a result of corruption, citizens' dependence on the arbitrariness of those in power is formed due to abuse of managerial authority within public authorities. Corruption creates barriers to entry in certain industries, which also negatively affects the functioning of innovative entrepreneurship. Over the last twenty years, various programs and sets of measures to combat corruption have been implemented at the state level, but the problem of corruption remains unresolved. The process of solving the problem is complicated by the latent nature of corruption against the background of normalization of this phenomenon in the minds of society, which is the result of misperception of corruption as a natural nature of the functioning of government and public institutions.

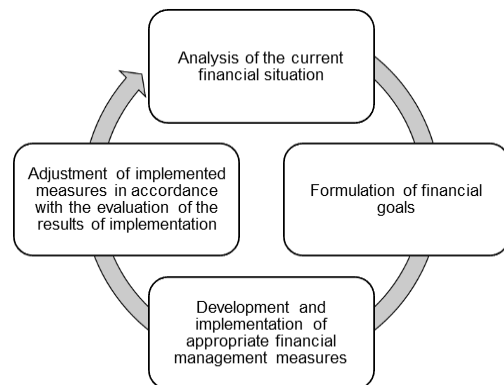
In the context of forming an institutional environment that can stimulate the development and ensure proper conditions for the functioning of innovative entrepreneurship, it is important to develop public administration, which is implemented within the system "State - Society". The mechanism of interaction of the main subjects of public administration is shown in Figure 3. It is due to the functioning of this mechanism that the interests of various social groups are coordinated in the process of institutional transformations. Public administration in Ukraine is characterized by the following features: the shift of public consciousness towards democratization and democratic governance, the need for systemic reforms aimed at implementing the legal and managerial experience of developed countries, the need for transformation to bring together the interests of citizens and public authorities.



**Figure 3. The mechanism of interaction of the main subjects of public administration**  
Source: developed by the author

It is important to note that the role of civil society in the mechanism of public administration is growing in comparison with "traditional" public administration, the functions of which include: solving socially important issues at the level of local self-government or within public associations; ensuring the protection of civil rights and freedoms; articulation of citizens' demands, which reduces social tensions and provides feedback to the democratic government; ensuring the protection of the interests of certain groups of citizens among other interest groups, provided that all interest groups have equal opportunities. Creating conditions for the development of civil society is the key to improving the efficiency of the public administration mechanism. However, the activities of state bodies also need to be reformed, namely: increasing the efficiency of executive bodies at all levels of government; implementation of foreign experience of modern systems of local self-government bodies; implementation of effective legal and organizational principles of public administration of administrative-territorial units. The aim of the reform should be a substantial transformation of the authorities, not declarative changes in regulations.

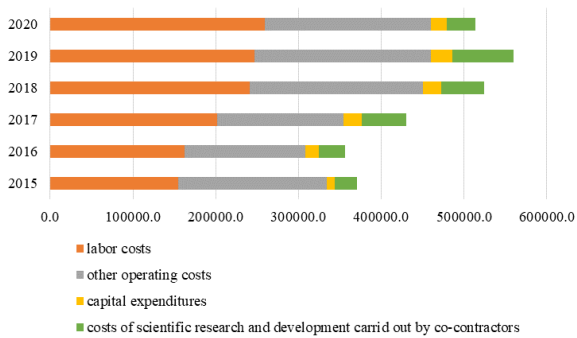
Based on the above, the implementation of financial planning of economic entities in the field of innovative enterprise can reduce the degree of uncertainty and increase the level of financial efficiency. The process of financial planning should be carried out according to the algorithm shown in Figure 4.



**Figure 4. The general algorithm of financial planning of innovative business subjects**  
Source: developed by the author

Analysis of the current financial condition of innovative entrepreneurs is a key element of financial planning, because problems, that entrepreneurs face and create a basis for developing financial measures to address them, can be identified through this analysis. The study of gross expenditures on research and development for the period from 2015 to 2020 (Figure 5) highlights the following: during this period there is a tendency to increase costs with fluctuations in 2016 and 2020,

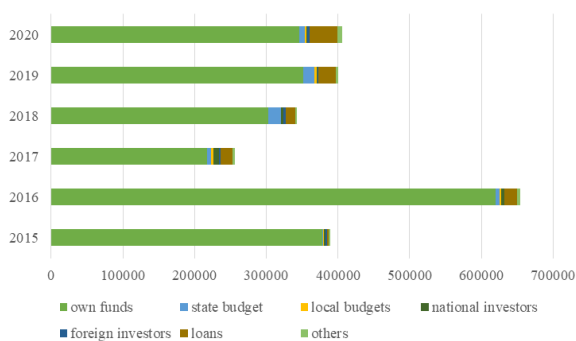
the largest amount of expenditures recorded in 2019, there is a stable increase in labor costs for the corresponding period by 68%, capital expenditures increased until 2019, but in 2020 there was a decrease in capital expenditures by 27%.



**Figure 5. Gross expenditures for research and development for the period from 2015 to 2020 (thousand EUR)**

Source: developed by the author according to the State Statistics Service of Ukraine [18]

The total amount of funding for innovation for the period from 2015 to 2020 is characterized by an increase of 4.3%. The total amount of funding for innovation by source for the period from 2015 to 2020 is shown in Figure 6.



**Figure 6. The total amount of funding for innovation by source for the period from 2015 to 2020 (thousand EUR)**

Source: developed by the author according to the State Statistics Service of Ukraine [18]

The largest share of financing of innovation activities comes from own funds, the largest value was recorded in 2016. Financing from foreign investors increased by about 114% during the period, while financing from domestic investors decreased by 39%. The share of loan financing increased by 1110%, but this growth rate is largely due to the "low base" effect. Despite the fact that compared to 2015, funding from the state budget in 2020 increased, but over the past three years there has been a downward trend. Thus, in the period from 2018 to 2020 there was a decrease in funding from public funds by 56%.

At the stages of analysis of the current financial condition and evaluation of the results of the implementation of the developed financial measures to achieve the set financial goals, it is advisable to assess the effectiveness and efficiency of innovation.

Achieving economic efficiency and effectiveness is the goal of any business. To assess the effectiveness and efficiency usually use relative indicators that allow to compare the volume of sold innovative products or the volume of produced innovative products to the corresponding amount of costs for innovation. However, taking into account that innovation activity has features, in order to determine the economic efficiency of innovative entrepreneurship, it is advisable to use integrated assessment. It is appropriate to build an integrated performance indicator, including the following components: number of enterprises that sold innovative products that were new to the market (R1), number of industrial enterprises that implemented innovations (R2), volume of sold innovative products that were new to the market (R3), return on one hryvnia of costs for research and development (R4).

The selected indicators have different units of measurement and heterogeneous nature, so in order to bring them to a uniform form, it is advisable to carry out the standardization procedure according to formula (1).

$$r_{ij} = (v_{ij} - \bar{v}_j) \cdot \left( \left( (n-1)^{-1} \cdot \sum_{i=1}^n (v_{ij} - \bar{v}_j)^2 \right)^{\frac{1}{2}} \right)^{-1} \quad (1)$$

Where:  $r_{ij}$  - standardized value of a separate indicator  $j$  for period  $i$ ;  $v_{ij}$  - the value of a single indicator  $j$  for period  $i$ ;  $\bar{v}_j$  - the arithmetic mean of an individual indicator  $j$ ;  $n$  - the number of observations of a single indicator  $j$ .

To calculate the partial coefficients  $k_j$  it is advisable to use the following formula (2):

$$k_j = (r_{ij} - r_{min}) \cdot (l_2 - l_1) \cdot (r_{max} - r_{min})^{-1} + l_1 \quad (2)$$

Where:  $k_j$  - partial coefficient of an individual indicator  $j$ ;  $r_{ij}$  - standardized value of a separate indicator  $j$  for period  $i$ ;  $r_{max}$  - the maximum value of the indicator  $j$ ;  $r_{min}$  - the minimum value of the indicator  $j$ ;  $l_1$  - the minimum value of the given  $r_{ij}$ ;  $l_2$  - the maximum value of the given  $r_{ij}$ .

The values of the calculated partial coefficients are given in Table 1.

**Table 1. Calculated partial coefficients are an integral indicator of efficiency**

Year	$k_1$	$k_2$	$k_3$	$k_4$
2015	0.75490	0.88060	0.88060	0.74232
2016	0.95098	0.97015	0.97015	0.70259
2017	0.66667	0.50000	0.50000	0.50000
2018	1.00000	1.00000	1.00000	0.55367
2019	0.50000	0.61194	0.61194	0.67233
2020	0.78922	0.84328	0.84328	1.00000

Source: developed by the author according to the State Statistics Service of Ukraine [18].

To calculate the integrated index, it is advisable to use the geometric mean of the partial coefficients according to formula (3).

$$IR = (k_1 \cdot k_2 \cdot \dots \cdot k_m)^{1/m} \quad (3)$$

Where:  $IR$  - integrated indicator of the effectiveness of innovative entrepreneurship;  $k_j$  - partial coefficient of a single indicator  $j$  provided  $j \in [1; m]$ ;  $m$  - number of individual indicators.

The results of the calculation are shown in Table 2.

**Table 2. An integrated indicator of the effectiveness of innovative entrepreneurship**

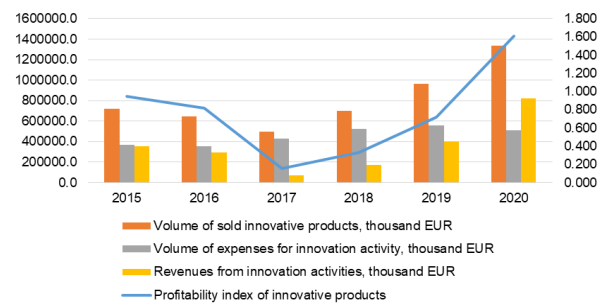
Year	$IR$	Year	$IR$
2015	0,811911431	2018	0,862606052
2016	0,890506175	2019	0,595651484
2017	0,537284966	2020	0,865537223

Source: developed by the author according to the State Statistics Service of Ukraine [18].

Analysis of the dynamics of the integrated indicator of the effectiveness of innovative entrepreneurship allows to explore the changes that have arisen as a result of the implementation of the developed measures.

Also, the economic efficiency of innovative entrepreneurship can be assessed by studying the dynamics of the amount of income from innovation, as well as the index of profitability of innovative products.

The dynamics of the selected indicators indicates that since 2017 there has been an increase in the volume of sold innovative products and reached its maximum value in 2020. The same trend is typical for revenues from innovation and profitability index, which are growing during 2017 - 2020. The volume of expenditures on innovation was the lowest in 2016, and reached its maximum in 2019. The dynamics of economic efficiency of innovative entrepreneurial activity in Ukraine for the period 2015 - 2020 is shown in Figure 7.

**Figure 7. Dynamics of economic efficiency of innovative entrepreneurial activity in Ukraine for the period 2015-2020**

Source: developed by the author according to the State Statistics Service of Ukraine [18]

At the next stage of planning, the construction of economic and mathematical model of the time series will identify patterns, prospects and forecast for future periods. It is thanks to scientifically sound forecasts that management is able to adequately formulate strategic goals, develop sets of measures to achieve these goals. Thus, the result of forecasting is a forecast that allows to identify possible changes in the financial efficiency of entrepreneurship, in particular, helps to develop alternative measures.

To build a predictive model, a parabolic trend is used, i.e. a trend that is represented by a second-order parabola, which has the form:

$$y_t = \alpha + \beta \cdot t + \sigma \cdot t^2 \quad (4)$$

Where:  $\alpha$  - the average level of the trend at the beginning of the reference, i.e. provided  $t = 0$ ;  $\beta$  - the average annual increase for the entire observation period, which is not constant and varies evenly with an average acceleration of 2;  $\sigma$  - the parameter of the parabola of the second order, which is a constant.

The use of the parabolic function of the second order allows us to depict trends in dynamics, which are characterized by a relatively constant acceleration of absolute changes in levels. However, the higher the order of the parabolic function, the closer the trend line shifts to the original empirical series, resulting in a mixture of trend and fluctuations. That is why the use of a higher order parabolic function is impractical. In the context of the analysis of the constructed model, it is important to take into account the mathematical properties of the parabolic model.

First, the trend is characterized by the signs of the parameters  $\beta$  and  $\sigma$  provided that  $\alpha > 0$ . Then if  $\beta > 0$  and  $\sigma > 0$ , there is a tendency to accelerate the growth of levels. If  $\beta < 0$  and  $\sigma < 0$ , then there is a tendency to accelerate the collapse of levels. Under the conditions of  $\beta > 0$  and  $\sigma < 0$ , there is a tendency to inhibit the growth of ascending branch levels. Under the

conditions of  $\beta < 0$  and  $\sigma > 0$ , there is a tendency to inhibit the growth of descending branch levels.

### 3. Results and Discussion

Analysis of the integrated performance indicator of innovative entrepreneurship indicates that performance is characterized by significant fluctuations, but since 2019 there has been a steady increase in performance. This is due to an increase in the return per hryvnia of costs spent on research and development and an increase in the number of enterprises that implement innovative technologies.

The economic and mathematical models that allow to make forecasts are given in Table 4. All models are adequate and have a high value of reliability, which allows to fairly accurately identify trends in changes in economic efficiency of entrepreneurship in the field of innovation. Based on the above, it is advisable to use the obtained models to build forecasts.

Using the obtained models, the prognostic values of indicators for the period 2021-2022 were calculated. The results obtained are shown in Table 5.

The indicators calculated with the help of economic and mathematical models indicate the positive dynamics of the volume of sold innovative products, which will amount to 1.883,35 mln. EUR, and 2.560,34 mln. EUR in 2021 and 2022, respectively. Also, positive dynamics is

observed in changes in revenues from innovation, so the forecast value in 2021 will be 1.335,077 mln. EUR, and in 2022 - 2.016,76 mln. EUR. According to forecast data, the profitability index of innovative products in 2021 will be equal to 2,63, and in 2022 - 3,71. While the volume of expenditures on innovation, on the contrary, is experiencing a slight negative trend and will amount to 548,31 mln. EUR in 2021 and mln. EUR 543,6 in 2022.

On the basis of the received forecast data, complex measures which are directed on achievement of the set purposes can be developed.

### 4. Conclusions

- In a market economy, financial management is a key element of management for innovative entrepreneurs, as it allows to achieve efficiency of economic activity through the use of various methods and techniques to increase profitability and minimize situations of uncertainty. The purpose of entrepreneurial activity is to obtain the maximum financial benefit of the business entity, and through the management of financial resources it is possible to ensure financial stability, profitability, solvency of the enterprise and raise funds for research, innovation projects. An important component of financial management is financial planning, which can be carried out at the level of an individual entity, as well as at the level of individual industries, regions, national economy. Rational financial planning provides long-term

**Table 4. Economic and mathematical models of the dynamics of economic efficiency of entrepreneurship in the field of innovation**

Indexes	$\alpha$	$\beta$	$\sigma$	Model	$R^2$
Volume of sold innovative products, mln EUR	1038.56	-366.09	69.54	$Y = 69.54t^2 - 366.09t + 1038.56$ ( $\alpha > 0; \beta < 0; \sigma > 0$ )	0.9784
Expenditures on innovation activities, mln EUR	264.36	80.17	-5.66	$Y = -5.66t^2 + 80.17t + 264.36$ ( $\alpha > 0; \beta > 0; \sigma < 0$ )	0.8179
Revenues from innovation activities, mln EUR	774.19	-446.24	75.2	$Y = 75.2t^2 - 446.24t + 774.19$ ( $\alpha > 0; \beta < 0; \sigma > 0$ )	0.9482
Profitability index of innovative products	1.9942	-1.0683	0.1655	$Y = 0.1655t^2 - 1.0683t + 1.9942$ ( $\alpha > 0; \beta < 0; \sigma > 0$ )	0.8963

Source: developed by the author

**Table 5. Prognostic values of indicators are calculated**

Index	Prognostic values	
	2021	2022
Volume of sold innovative products, mln EUR	1883.35	2560.34
Expenditures on innovation activities, mln EUR	548.31	543.6
Revenues from innovation activities, mln EUR	1 335.077	2 016.77
Profitability index of innovative products	2.63	3.71

Source: developed by the author.



strategic adaptation. In the process of financial planning, indicators are calculated that characterize the current financial condition and allow to predict possible trends in changes in their values. Forecasting as an integral part of financial planning allows to develop strategic, current and operational financial budgets and plans.

- Assessing the effectiveness of innovation, it is proposed to use an integrated indicator, which was built on the following components: the number of enterprises that sold innovative products that were new to the market, the number of industrial enterprises that implemented innovations, the volume of sold innovative products that were new to the market; return on one hryvnia costs of research and development. Analysis of the dynamics of the integrated performance indicator for the period 2015 - 2020 reveals significant fluctuations, but since 2019 the effectiveness of innovative entrepreneurship is growing.

- In order to achieve the goal of the study, statistical data characterizing the economic efficiency of innovation in Ukraine for 2015 - 2020 were analyzed. During the study period, such indicators as the index of profitability of innovative products, revenues from innovative activities and the volume of sold innovative products reached minimum values in 2017. And since 2017, their growth has been observed, i.e. in 2020 these indicators reached the highest values. The lowest amount of expenditures on innovation was recorded in 2016, and the largest expenditures on innovation were spent in 2019. Using methods of economic and mathematical modeling, econometric models were built, which allowed to obtain forecast values of these indicators for the period 2021 - 2022. The study of these forecasts indicates a positive dynamics of the index of profitability of innovative products, the volume of sold innovative products and revenues from innovative activities, while the volume of expenditures on innovative activities is characterized by negative dynamics in this period. However, it is important at the state level to ensure the development and implementation of policies aimed at realizing Ukraine's innovation potential, which will increase the efficiency of innovative entrepreneurship.

- It should be noted that the analysis of the factors of innovative entrepreneurship reflects the significant influence of the institutional environment and public administration in particular. The immaturity of the institutional environment increases the relevance of financial planning for the subjects of innovative entrepreneurship, at the same time, the negative effects that result from the low level of development of institutions, greatly complicate this process. In order to develop the institutional environment, it is advisable to reduce the degree of regulation of economic activity, increase the level of efficiency of public authorities,

implement effective measures to combat corruption, create mechanisms for solving Paying capacity problems.

- Also, the development of public administration will increase the efficiency of management decisions at all levels, which in turn will create conditions for the intensification of entrepreneurial activity, in particular in the field of innovation. To this end, the achievements of digitalization can be used, which allow: to optimize the process of participation in public administration, in particular innovative entrepreneurs, through the organization of interactive consultations with NGOs or members of the public; creation of interactive systems of involvement of public organizations in the formation and implementation of measures to solve economic and social problems of society; to carry out educational and informational activities on the role of the public in public administration.

## 5. References

- [1] Baumol W. (2010). *The Microtheory of Innovative Entrepreneurship*. Princeton University Press, Princeton, USA.
- [2] Szabo Z.K., Herman E. (2012). *Innovative entrepreneurship for economic development in EU*. Economics and Finance Procedia, 3, pp. 268-275.
- [3] Crudu R. (2019). *The role of innovative entrepreneurship in the economic development of EU member countries*. Journal of Entrepreneurship, Management and Innovation, 15, (1), pp. 35-60.
- [4] Khodakivska O., Kobets S., Bachkir I., Martynova L., Klochan V., Klochan I., Hnatenko I. (2022). *Sustainable development of regions: Modeling the management of economic security of innovative entrepreneurship*. International Journal of Advanced and Applied Sciences, 9, (3), pp. 31-38.
- [5] Mazur N., Khrystenko L., Pásztorová J., Zos-Kior M., Hnatenko I., Puzyrova P., Rubezhanska V. (2021). *Improvement of Controlling in the Financial Management of Enterprises*. TEM Journal, 10, (4), pp. 1605-1609.
- [6] Giraudo E., Giudici G., Grilli L. (2019). *Entrepreneurship policy and the financing of young innovative companies: Evidence from the Italian Startup Act*. Research Policy, 48 (9). <URL:<http://www.sciencedirect.com/science/article/pii/S0048733319301210>. Accessed 26 June 2021.
- [7] Vecchi V., Brusoni M., Borgonovi E. (2014). *Public Authorities for Entrepreneurship: A management approach to execute competitiveness policies*. Public Management Review, 16, (2), pp. 256-273.
- [8] Bradley S. W., Kim P. H., Klein P. G., McMullen J. S., Wennberg K. (2021). *Policy for innovative entrepreneurship: Institutions, interventions, and societal challenges*. Strategic Entrepreneurship Journal, 15, pp. 167-184.
- [9] Henrekson M., Stenkula M. (2010). *Entrepreneurship and Public Policy*. Handbook of Entrepreneurship Research. Springer, New York, USA, pp. 595-637.
- [10] Elert N., Henrekson M. (2021). *Innovative entrepreneurship as a collaborative effort: An institutional framework*. IFN Working Paper. <URL:<https://www.ifn.se/wfiles/wp/wp1345.pdf>. Accessed 28 June 2021.

- [11] Wang R., Zhou W. C. (2020). *The influence of regional institutional setting on the performance of innovative entrepreneurship: An emerging market perspective*. Chinese Management Studies, 14, (3), pp. 639-659.
- [12] Amini Sedeh A., Pezeshkan A., Caiazza R. (2021). *Innovative entrepreneurship in emerging and developing economies: The effects of entrepreneurial competencies and institutional voids*. The Journal of Technology Transfer, 47, (4), pp. 1198-1223.
- [13] Accordino P. (2020). *Fiscal Policy for Sustainable Development: The Italian Way to Promote Innovative Entrepreneurship According to European Union Rules*. In: Mauerhofer V., Rupo D., Tarquinio L. (Eds.), Sustainability and Law, Springer Cham, USA, pp. 201-219.
- [14] Mayovets Y., Vdovenko N., Shevchuk H., Zos-Kior M., Hnatenko I. (2021). *Simulation modeling of the financial risk of bankruptcy of agricultural enterprises in the context of COVID-19*. Journal of Hygienic Engineering and Design, 36, pp. 192-198.
- [15] Wilson K. E. (2015). *Policy Lessons from Financing Innovative Firms*. OECD Science, Technology and Industry Policy Papers. <URL: [https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/IND\(2014\)5/FINAL&docLanguage=En](https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/IND(2014)5/FINAL&docLanguage=En). Accessed 28 June 2021.
- [16] Ogochukwu I. J. (2021). *Entrepreneurship Innovation and Finance*. Journal of Behavioural Economics Finance Entrepreneurship Accounting and Transport, 9, (1), pp. 16-35.
- [17] Ugrinovska L. (2022). *Essays on financing business innovation*. PhD thesis, Australian National University, Canberra, Australia.
- [18] State Statistics Service of Ukraine. *Scientific and innovation activities Ukraine* (in Ukrainian). <URL: [https://ukrstat.gov.ua/druk/publicat/kat\\_u/publnauka\\_u.htm](https://ukrstat.gov.ua/druk/publicat/kat_u/publnauka_u.htm). Accessed 28 June 2021.
- [19] Cornell University, INSEAD, WIPO. *Global Innovation Index*. <URL: <https://www.wipo.int/publications/en/series/index.jsp?id=129>. Accessed 28 June 2021.