

## INNOVATIVE MANAGEMENT OF ECO-PROJECTS OF QUALITY AND SUSTAINABLE DEVELOPMENT OF THE ENTREPRENEURIAL POTENTIAL OF INTEGRATED STRUCTURES IN SMART TECHNOLOGIES OF THE INFORMATION BIO-ECONOMY

*Iryna Shtuler<sup>1</sup>, Oleh Romanchuk<sup>2</sup>, Tetiana Kharchuk<sup>3</sup>, Hanna Popovychenko<sup>4</sup>, Tetiana Vlasiuk<sup>5</sup>, Zorina Shatskaya<sup>6</sup>, Denys Zakharov<sup>7</sup>*

<sup>1</sup> Dr. Prof., National Academy of Management, 15 Ushynskoho str., Kyiv, Ukraine, E-mail address: [shkirka2002@ukr.net](mailto:shkirka2002@ukr.net)

<sup>2</sup> PhD. Student, Lviv Polytechnic National University, 12 S. Bandera str., Lviv, Ukraine, E-mail address: [oleh.i.romanchuk@lpnu.ua](mailto:oleh.i.romanchuk@lpnu.ua)

<sup>3</sup> Prof. National University of Ukraine on Physical Education and Sport, 1 Fizkultury str., Kyiv, Ukraine, E-mail address: [tkharchuk@uni-sport.edu.ua](mailto:tkharchuk@uni-sport.edu.ua)

<sup>4</sup> Assoc. Prof., Vadym Hetman Kyiv National University of Economics, 54/1 Beresteysky pr., Kyiv, Ukraine, E-mail address: [gannapopovichenko@gmail.com](mailto:gannapopovichenko@gmail.com)

<sup>5</sup> Assoc. Prof., Kyiv National University of Technologies and Design, 2 Mala Shyianovska (Nemyrovycha-Danchenka) str., Kyiv, Ukraine, E-mail address: [vlsiuktm@gmail.com](mailto:vlsiuktm@gmail.com)

<sup>6</sup> Assoc. Prof., Kyiv National University of Technologies and Design, 2 Mala Shyianovska (Nemyrovycha-Danchenka) str., Kyiv, Ukraine, E-mail address: [shatskaya@ukr.net](mailto:shatskaya@ukr.net)

<sup>7</sup> PhD. Student, O. M. Beketov National University of Urban Economy in Kharkiv, 17 Bazhanov str., Kharkiv, Ukraine, E-mail address: [zakharovds@online.ua](mailto:zakharovds@online.ua)

Received 06 05 2024; Accepted 12 06 2024

### Abstract

The article considers the value of forecasting the net income from the sale of products in innovative eco-projects through the lens of modern mathematical models. The obtained data demonstrate a significant influence of social and technological factors on the economic results of enterprises in the sector of ecological products. The use of mathematical models emphasizes the importance of an adaptive approach in project management, which allows more accurate consideration of the specifics of market conditions. The forecasting results indicate a significant potential for sustainable development of entrepreneurial potential, where innovative technologies become a catalyst for economic growth. The proposed approach emphasizes the need for science-based solutions in the field of innovation management and promotes the integration of smart technologies into the bioeconomy, which is critical for ensuring environmental responsibility in the modern business environment.

**Keywords:** *innovative management, eco-projects, quality, sustainable development, entrepreneurial potential, integrated structures, smart technologies, bio-economy.*

**JEL Codes:** *D22, O32, Q57.*

### Introduction

Modern challenges related to environmental problems and the needs of sustainable development put new demands on enterprises regarding their management and innovative strategies. Eco-innovation is becoming key to increasing competitiveness in the market, as consumers increasingly pay

attention to the environmental characteristics of products and services. In this context, the management of eco-projects, which are based on the principles of sustainable development, acquires special importance. The introduction of new technologies into production, together with the analysis of economic indicators, such as net income from product sales, becomes an integral

part of the successful operation of enterprises. One of the main tools for evaluating the effectiveness of eco-projects is mathematical modeling, which allows you to identify the relationships between social, technological and economic factors. Analyzing data using various models helps businesses predict their financial results, as well as form strategies aimed at optimizing resources and improving sustainability. Thus, the study of innovation management in the context of eco-projects based on sustainable development is not only timely, but also critically important for ensuring the competitiveness and long-term viability of enterprises.

### **Literature review**

A literature review on the topic of our article on innovative management in eco-projects, in particular in the context of sustainable development of entrepreneurial potential, opens up a wide field for analysis that combines environmental, economic and social aspects of business. In today's world, where environmental problems are emerging on a new scale, companies are forced to adapt their management strategies to meet the requirements of sustainable development.

Innovative management, safety, education, technology, and resource conservation become the main mechanism that ensures the integration of new technologies, environmental practices, and business strategy [1-8].

Separate studies show that environmental innovations, marketing, energy efficiency, effective management and finance, successful convergence of accounting can significantly increase the competitiveness of enterprises [9-15]. They allow not only to reduce the ecological footprint, but also to provide economic benefits due to increased production efficiency and reduced resource costs. In this context, the role of the system of regulations and state support, which stimulates the introduction of environmental innovations, is important.

According to the works of a number of authors, proper management of innovation processes can significantly improve the financial indicators of enterprises, as well as increase their reputation among consumers.

In the literature, attention is also paid to various methods of evaluating the effectiveness of eco-projects, management in education, the need to develop the agricultural sector on the basis of energy saving and digitalization [16-19]. Analysis, including linear and non-linear models, is considered one of the most common tools for predicting the results of innovation implementation, which allows enterprises not only to assess the impact of environmental factors on economic indicators, but also to understand how social and technological changes can affect their activities.

Many researchers emphasize the importance of quantitative models in planning strategies in the context of globalization, marketing management, educational technologies, higher education management, as they allow to reveal hidden regularities in data and formulate reasonable forecasts based on them [20-26].

The importance of the integration of smart technologies, the formation of international transport and logistics infrastructure, proper psychological education and the sustainability of the agricultural sector is also growing [27-29]. The introduction of such technologies can not only reduce costs, but also increase the speed of response to changes in the market, which, in turn, contributes to greater business adaptability.

So, the literature review indicates that innovative management in the field of eco-projects is a complex and multifaceted process that requires the integration of various knowledge, education and technologies. Successful implementation of such projects requires an integrated approach that includes not only technical and economic aspects, but also social and environmental ones. In the future, it will be important to continue research in this area, which will help enterprises to implement innovations with maximum benefit both for themselves and for society as a whole.

### **Methodical approach**

In the context of innovative management of eco-projects, it is important to take into account the methods and tools that allow for a detailed analysis of the internal environment of the enterprise, as well as external factors affecting its activities. One of the key approaches

is an analysis that provides identification of the company's strengths and weaknesses, as well as opportunities and threats that may affect the implementation of eco-projects. In addition, the PEST analysis (political, economic, social and technological factors) is another important tool that allows you to assess the external conditions in which the enterprise operates. Within the framework of this methodology, it is possible to analyze the influence of state policy on the development of eco-projects, changes in economic conditions, social trends and technological innovations that can open new opportunities for enterprises in the bioeconomy. By combining the results of internal analysis with PEST analysis, enterprises can form effective strategies that meet the requirements of sustainable development. For example, the awareness of social changes associated with the growth of environmental consciousness of consumers can encourage enterprises to introduce new environmental products and services that meet these demands. Analysis of technological trends allows enterprises to adapt their production processes and innovation strategies to the changing market. Thus, the methods of analyzing the internal environment and PEST analysis are an integral part of the formation of effective strategies of innovative management of eco-projects, contributing to the sustainable development of entrepreneurial potential in the conditions of modern technological changes. The article also uses multiple linear and non-linear regression methods to analyze the impact of social and technological factors on income. The use of regression analysis allows you to assess the dependencies between variables, which is critically important in the context of innovative management of eco-projects, as it helps to determine how various factors affect the financial results of enterprises. In particular, modeling through linear and non-linear regressions allows you to gain a deeper understanding of the relationships between the quality of ecological products and entrepreneurial potential, which in turn provides opportunities for sustainable development in the conditions of the

bioeconomy. For example, the use of power, exponential and exponential regression in research allows you to better take into account nonlinear relationships between variables that may be absent in simple linear models. Such methods ensure the accuracy of forecasting net income and allow you to identify key factors that affect financial results, which is important for developing a management strategy for innovative eco-projects. Taking into account social and technological aspects in calculations is important for adaptation to modern challenges related to sustainable development and is an integral part of the quality management system within the framework of integrated structures working in smart technologies.

### **Results**

We selected five enterprises and their eco-projects for comprehensive research and analysis. At the beginning, we will briefly characterize them and analyze their internal environment. The analysis of the internal environment of five innovative eco-projects of 2023 demonstrates various aspects of the development of enterprises through the quantitative assessment of their work according to key indicators. The main criteria are marketing, finance, production and personnel, for each of which an assessment is made according to separate indicators, taking into account the weight of the criterion and the level of influence. This approach allows you to assess both the strengths and limitations of each business, and determine which elements should be focused on to improve performance.

The internal analysis of the company "Organic Milk" LLC shows that its strongest side is marketing, in particular thanks to the satisfactory quality of production and service, which provides a significant contribution to the overall competitiveness. At the same time, the company's financial resources also show good results due to the high cost of services, which allows the company to maintain stable profitability. Production is efficient, reflecting investments in modern equipment and technology that contribute to increased efficiency. In

personnel policy, a high assessment of the qualifications of management and personnel emphasizes the focus on the development of human capital, which ensures the company's stable development.

Product quality and service play a key role in Danube Agrarian LLC, which helps attract and retain customers. However, the financial component is unsatisfactory, which indicates a limitation in the level of profitability and stability, possibly due to the lower cost of services. In the manufacturing sector, the company demonstrates stability thanks to investments in modern technologies and capacities. In terms of personnel, the company is generally developing positively, which reflects a generally average level of qualification and division of duties, which needs further improvement.

“Stary Porytsk” LLC has shown strong results in marketing due to its high reputation and product quality. Financial stability is positive, allowing the company to maintain some financial independence, although return on investment is still an issue. Production at a high level thanks to significant investment in equipment that increases production capabilities. In terms of personnel, thanks to the high qualification of the management and staff, the company can develop stably, but the number of personnel somewhat limits the growth opportunities.

LLC “Skырskiy khiboproductiv” LLC demonstrates significant strength in production. In particular, quality products and service are key to maintaining market share. The company's production efficiency is ensured thanks to powerful modern equipment

and technologies. The company is financially stable, but there is a need to improve the return on investment. The personnel sector shows a significant entrepreneurial orientation and management qualification, which allows the company to be flexible and quickly adapt to market changes.

PE “Kompaniya Molfar” turned out to be weaker in terms of the main parameters. Marketing is weak, while service level and product quality are strengths. The financial component reflects problems with stability and low profitability, which limits investment opportunities. The manufacturing sector shows limited technological equipment, which restrains development and reduces efficiency. In terms of personnel, the company has an average level of qualification, although there is a lack of entrepreneurial orientation, which is important for innovative development.

The results of the internal analysis show that the strengths of the studied companies include high product quality, modern equipment and personnel qualifications. However, the main problems relate to financial stability and return on investment, which are a limitation to development. Businesses need to focus on strengthening financial stability, increasing the level of innovation and developing human capital, which will allow for sustainable development and effective competition in the market.

To study the influence of environmental factors on the innovative management of eco-projects of quality and sustainable development of the entrepreneurial potential of the five studied agricultural entities, a PEST analysis was conducted (Table 1).

**Table 1. PEST analysis of five researched innovative eco-projects, 2023**

PEST analysis for “Organic Milk” LLC										
Environmental factor	Impact strength	Impact weight	Expert ranking					Average coefficient	Weighted coefficient	
			1	2	3	4	5			
<b>Political factors</b>										
Military actions and occupation of territories	2	0,3	5	4	5	5	4	4,60	1,38	
Institutional and political support	2	0,2	2	3	2	3	2	2,40	0,48	
Change in the political situation	1	0,1	2	2	3	2	2	2,20	0,22	
Administrative barriers, state control and legislative conflicts	1	0,3	2	2	2	2	3	2,20	0,66	
Initiatives of local authorities and individual representatives of local police forces	1	0,1	1	2	2	1	1	1,40	0,14	
<b>Economic factors</b>										
Economic processes, emission and inflation	3	0,2	4	5	4	5	4	4,40	0,88	
Currency fluctuations	2	0,2	4	5	4	4	5	4,40	0,88	
The state of the background market and exchange activity	2	0,1	1	1	3	2	1	1,60	0,16	
Business climate and attraction of foreign donors	3	0,1	4	2	4	4	2	3,20	0,32	
Household incomes	2	0,2	2	3	2	2	3	2,40	0,48	
Transaction and transformation costs	3	0,2	3	4	4	3	4	3,60	0,72	
<b>Social - cultural factors</b>										
The level of the information and educational process	3	0,1	4	4	4	3	5	4,00	0,40	
Consumer attitudes	1	0,3	4	5	4	5	4	4,40	1,32	
Requirements for greening and savings	2	0,5	5	5	5	5	5	5,00	2,50	
Mentality and dominance of social groups	2	0,1	3	3	3	3	3	3,00	0,30	
<b>Technological factors</b>										
Scientific and technological progress	3	0,2	4	5	4	5	5	4,60	0,92	
Diffusion of innovations and knowledge	3	0,2	4	4	5	3	5	4,20	0,84	
International cooperation in the field of innovation	3	0,3	3	4	5	3	4	3,80	1,14	
Support of research projects	2	0,1	3	4	4	4	3	3,60	0,36	
Grant activity	2	0,1	3	3	5	4	4	3,80	0,38	
Innovative technological scientific infrastructure	2	0,1	2	1	2	2	2	1,80	0,18	
<b>In total</b>								70,60		
<b>PEST analysis for “Danube Agrarian” LLC</b>										
<b>In total</b>								65,60		
<b>PEST analysis for “Stariy Poritsk” LLC</b>										
<b>In total</b>								69,80		
<b>PEST analysis for “Skyrsky Combine of Bread Products” LLC</b>										
<b>In total</b>								68,40		
<b>PEST-analysis for PE “Company Molfar”</b>										
<b>In total</b>								59,00		

\*Source: calculated by the authors taking into account the financial and economic reporting of enterprises.

The conducted analysis made it possible to assess the degree of influence of certain factors on the development and activity of the five researched innovative eco-projects. For further analysis, modeling and forecasting, we

select two blocks of the PEST-analysis matrix: social and technological, of the studied business entities and determine their average value (Table 2).

**Table 2. Social and technological blocks of influencing factors on the development and operation of five innovative eco-projects, 2023**

“Organic Milk” LLC			
Social		Technological	
Factor	Weight	Factor	Weight
<b>Requirements for greening and savings</b>	<b>2,50</b>	<b>International cooperation in the field of innovation</b>	<b>1,14</b>
<b>Consumer attitudes</b>	<b>1,32</b>	<b>Scientific and technological progress</b>	<b>0,92</b>
Mentality and dominance of social groups	0,30	<b>Diffusion of innovations and knowledge</b>	<b>0,84</b>
In the weighted average value	<b>1,37</b>	Grant activity	0,38
		Support of research projects	0,34
		Innovative technological scientific infrastructure	0,18
		In the weighted average value	<b>0,63</b>
“Danube Agrarian” LLC			
Social		Technological	
Factor	Weight	Factor	Weight
<b>Requirements for greening and savings</b>	<b>2,30</b>	<b>International cooperation in the field of innovation</b>	<b>1,02</b>
<b>Consumer attitudes</b>	<b>1,32</b>	<b>Scientific and technological progress</b>	<b>0,88</b>
Mentality and dominance of social groups	0,36	<b>Diffusion of innovations and knowledge</b>	<b>0,64</b>
In the weighted average value	<b>1,33</b>	Grant activity	0,30
		Support of research projects	0,34
		Innovative technological scientific infrastructure	0,14
		In the weighted average value	<b>0,55</b>
“Stary Porytsk” LLC			
Social		Technological	
Weight	Factor	Weight	Factor
<b>Requirements for greening and savings</b>	<b>2,40</b>	<b>International cooperation in the field of innovation</b>	<b>1,08</b>
<b>Consumer attitudes</b>	<b>1,20</b>	<b>Scientific and technological progress</b>	<b>0,96</b>
Mentality and dominance of social groups	0,26	<b>Diffusion of innovations and knowledge</b>	<b>0,80</b>
In the weighted average value	<b>1,29</b>	Grant activity	0,36
		Support of research projects	0,34
		Innovative technological scientific infrastructure	0,18
		In the weighted average value	<b>0,62</b>
LLC “Skysky Bread Products Factory”			
Social		Technological	
Weight	Factor	Weight	Factor
<b>Requirements for greening and savings</b>	<b>2,50</b>	<b>International cooperation in the field of innovation</b>	<b>1,20</b>
<b>Consumer attitudes</b>	<b>1,26</b>	<b>Scientific and technological progress</b>	<b>0,92</b>
Mentality and dominance of social groups	0,30	<b>Diffusion of innovations and knowledge</b>	<b>0,84</b>

In the weighted average value		<b>1,35</b>	Grant activity	0,38
			Support of research projects	0,34
			Innovative technological scientific infrastructure	0,20
			In the weighted average value	<b>0,65</b>
PE "Company Molfar"				
Social			Technological	
Weight	Factor		Weight	Factor
<b>Requirements for greening and savings</b>	<b>2,20</b>		<b>International cooperation in the field of innovation</b>	<b>0,72</b>
<b>Consumer attitudes</b>	<b>1,14</b>		<b>Scientific and technological progress</b>	<b>0,84</b>
Mentality and dominance of social groups	0,40		<b>Diffusion of innovations and knowledge</b>	<b>0,60</b>
In the weighted average value		<b>1,25</b>	Grant activity	0,26
			Support of research projects	0,34
			Innovative technological scientific infrastructure	0,14
			In the weighted average value	<b>0,48</b>

\*Source: calculated by the authors taking into account the financial and economic reporting of enterprises.

Next, we proceed to the economic-mathematical processing of the selected topic. For the analysis, modeling and forecasting of the innovative management system of eco-projects of quality and sustainable development of the entrepreneurial potential of the five presented business entities, we select the above calculated social and technological factors of influence on the development and activity of eco-projects for the production of organic products, and as a result of this activity, the

indicator is net income from sales of products (goods, works, services) over the past five years. We use the materials of the electronic financial reporting of the investigated enterprises "Balance Sheet Form No. 1" and "Report on Financial Results Form No. 2". The dynamics of social and technological factors influencing the net income from the sale of products (goods, works, services) over the past five years is presented in the table. 3.

**Table 3. Dynamics of social and technological factors influencing net income from the sale of products (goods, works, services) of five innovative eco-projects, 2019-2023**

"Organic Milk" LLC			
Years	Social influencing factors quality of ecological products	Technological factors of sustainable development of entrepreneurial potential	Net income from the sale of products (goods, works, services), thousand UAH
2019	1,38	0,70	225138,00
2020	1,41	0,69	251846,00
2021	1,39	0,65	271196,00
2022	1,33	0,60	204739,00
2023	1,37	0,63	217365,00
"Danube Agrarian" LLC			
Years	Social influencing factors quality of ecological products	Technological factors of sustainable development of entrepreneurial potential	Net income from the sale of products (goods, works, services), thousand UAH
2019	1,21	0,41	35474,00
2020	1,24	0,46	36622,00
2021	1,28	0,49	38770,00
2022	1,32	0,54	44918,00
2023	1,33	0,55	80007,00
"Stary Porytsk" LLC			

Years	Social influencing factors quality of ecological products	Technological factors of sustainable development of entrepreneurial potential	Net income from the sale of products (goods, works, services), thousand UAH
2019	1,32	0,70	2347,50
2020	1,22	0,68	2839,40
2021	1,18	0,64	3193,10
2022	1,11	0,60	2838,93
2023	1,29	0,62	3061,73
LLC "Skysky Bread Products Factory"			
Years	Social influencing factors quality of ecological products	Technological factors of sustainable development of entrepreneurial potential	Net income from the sale of products (goods, works, services), thousand UAH
2019	1,45	0,71	437288,00
2020	1,49	0,74	500125,00
2021	1,38	0,72	600159,00
2022	1,31	0,63	658168,00
2023	1,35	0,65	522772,00
PE "Company "Molfar"			
Years	Social influencing factors quality of ecological products	Technological factors of sustainable development of entrepreneurial potential	Net income from the sale of products (goods, works, services), thousand UAH
2019	1,12	0,39	15466,00
2020	1,00	0,38	11828,00
2021	1,20	0,44	21833,90
2022	1,18	0,40	118653,30
2023	1,25	0,48	181661,30

*\*Source: calculated by the authors taking into account the financial and economic reporting of enterprises.*

The analysis of the dynamics of social and technological factors influencing the net income from the sale of products of five innovative eco-projects for the period from 2019 to 2023 shows various trends in the relationship of these factors with the income of companies. Each enterprise demonstrates its own trajectory of changes in net income, which reflects the specifics of responding to social and technological changes.

In LLC "Organic Milk", a relatively stable level of social factors of the quality of ecological products is observed, with an indicator ranging from 1.33 to 1.41 during the analyzed period. Technological factors of sustainable development, in contrast, show a slight decrease from 0.70 in 2019 to 0.63 in 2023. With the net income from the sale of products, there is a noticeable upward trend in 2019–2021, which was accompanied by an increase in income from UAH 225,138 thousand to UAH 271,196 thousand. However, in 2022, the income will decrease to UAH 204,739 thousand, which may be the result of a decrease in both technological factors and the impact of macroeconomic

conditions. Despite this, in 2023 the income grows to UAH 217,365 thousand, which indicates a certain stabilization.

For Danube Agrarian LLC, social impact factors increase gradually from 1.21 to 1.33 during the analyzed period, and technological factors steadily improve from 0.41 to 0.55. Such dynamics is reflected in the growth of the company's net income, which increases especially sharply in 2023, reaching UAH 80,007 thousand compared to UAH 35,474 thousand in 2019. This increase may indicate the positive impact of improving social and technological indicators on the financial results of the company, in particular in the direction of improving the quality of eco-products and technological modernization.

"Stary Porytsk" LLC has a significant fluctuation in social and technological indicators. Social factors decrease from 1.32 in 2019 to 1.11 in 2022, further increasing to 1.29 in 2023. Technology factors also decrease slightly over the period, from 0.70 to 0.62. Such dynamics is reflected in the net income, which peaks in 2021



(3193.10 thousand UAH), after which it decreases in 2022 and recovers somewhat in 2023 (3061.73 thousand UAH). Overall, the company's revenues remain stable but low, which may indicate the impact of technological volatility.

“Skырskiy Kombinat Hliboproduktiv” LLC shows consistently high indicators of social and technological factors, although their value decreases slightly in 2022, when technological factors fall from 0.74 in 2020 to 0.63. This is reflected in the net income, which increased significantly from UAH 437,288 thousand in 2019 to UAH 658,168 thousand in 2022, and decreased to UAH 522,772 thousand in 2023. Perhaps the fall in income is partly explained by changes in the technological component and the influence of external economic conditions.

PE “Company Molfar” shows the most significant changes in net income during the analyzed period. There is a significant increase

in both social and technological factors, which contributes to a sharp increase in income, especially in 2023, when the net income is UAH 181,661.3 thousand, which indicates a direct positive impact of modernization and improving the quality of ecological products on the company's performance .

Overall, the analysis shows that social and technological factors have a significant impact on net sales revenue. The most successful projects demonstrate both an increase in quality and technology indicators and an increase in income, while a decrease or instability of these factors is accompanied by a drop in income, which emphasizes the importance of investment in product quality and technological development to maintain and grow income in today's market conditions. For further calculation and bringing the production models to a mathematical form, we denote the factors and the indicator as variables (Table 4).

**Table 4. Designation of factors and indicators as variables for the formulation of linear and non-linear multiple production regression models**

X <sub>0</sub>	– fictitious factor (is mandatory in economic-mathematical modeling)
X <sub>1</sub>	– social factors influencing the quality of ecological products
X <sub>2</sub>	- technological factors of sustainable development of entrepreneurial potential
Y	- net income from the sale of products (goods, works, services), thousand UAH.

\*Source: suggested by the authors.

Further calculations are carried out using linear multiple regression and nonlinear multiple regressions. As a result of calculations, multiple linear and non-linear production regressions have the form:

	multiple linear production regression
	$Y_r = -1019060.78 + 1058167.32X_1 - 311037.82X_2$
	multiple non-linear power-law regression
	$\hat{Y}_i = -30499.13X_1 + 11.88X_2 - 0.15$
“Organic Milk” LLC	multiple nonlinear exponential production regression
	$\hat{Y}_i = 515218.51 * (-50707791017.63) X_1 * 6996631915.95X_2$
	multiple nonlinear exponential production regression
	$\hat{Y}_i = 3374874.36x_1 - 478348.90x_2 - 322537.93$
	multiple non-linear semi-log production regression
	$LN\hat{Y}_i = 10.05 + 6.15Z_1 - 0.81Z_2$
	multiple linear manufacturing regression
	$Y_r = 323646.79 - 456059.20X_1 + 621886.35 X_2$
“Danube Agrarian” LLC	multiple non-linear power-law regression
	$\hat{Y}_i = -296.02 * X_1 + 11.85 * X_2 - 0.22$
	multiple nonlinear exponential production regression
	$\hat{Y}_i = 123289.90 * (-2217756523.90) X_1 * (-983079383.07) X_2$
	multiple nonlinear exponential production regression
	$\hat{Y}_i = -25147.09 \exp_1 + 258961.88 \exp_2 + 130545.64$

	multiple non-linear semi-log production regression $LN\hat{Y}_i=11.69+1.10Z_1+1.73Z_2$
	multiple linear manufacturing regression $Y_r=6204.11-230.59X_1-4731.31X_2$
	multiple non-linear power-law regression $\hat{Y}_i=833.62 * X_{10.20} * X_{20.35}$
“Stary Porytsk” LLC	multiple nonlinear exponential production regression $\hat{Y}_i=4590.60*(-493752.15)X_1*(-6597089.67)X_2$
	multiple nonlinear exponential production regression $\hat{Y}_i=-474.40x_1-7016.21x_2+1570.27$
	multiple non-linear semi-log production regression $LN\hat{Y}_i=7.49+-0.11 Z_1-1.12Z_2$
	multiple linear production regression $Y_r=2001547.73-1703450.30X_1+ 1336518.76X_2$
	multiple non-linear power-law regression $\hat{Y}_i=120838.71 * X_{11.69} * X_{2-0.30}$
LLC “Skyrsky Bread Products Factory”	multiple nonlinear exponential production regression $\hat{Y}_i=964678.92*(-241957372480.47) X_1 * 166624543029.56X_2$
	multiple nonlinear exponential production regression $\hat{Y}_i= -5578050.82x_1+2146556.99x_2+1699078.64$
	multiple non-linear semi-log production regression $LN\hat{Y}_i=15.37-4.52Z_1+1.78Z_2$
	multiple linear manufacturing regression $Y_r=-567172.80+303800.44X_1+687643.31X_2$
	multiple non-linear power-law regression $\hat{Y}_i=-1628.80 * X_{11.68} * X_{2-0.16}$
PE “Company Molfar”	multiple nonlinear exponential production regression $\hat{Y}_i=349442.50*5.75 X_1*2.09X_2$
	multiple nonlinear exponential production regression $\hat{Y}_i=732749.13x_1+702355.29x_2+293314.77$
	multiple non-linear semi-log production regression $LN\hat{Y}_i=10.42+9.66Z_1+1.34Z_2$

The analysis of the presented production regression models for five enterprises reveals different approaches to the study of the influence of social and technological factors on net income. In general, the analysis of different types of production regressions for businesses provides a deeper understanding of how social and technological factors affect their net income. Linear models are convenient for a simple description of trends, while non-linear models (power, exponential, exponential and semi-log)

emphasize more complex relationships, helping to understand how changing factors can affect income with different intensity.

We are implementing the stage of forecasting the social and technological factors of the quality of ecological products and the sustainable development of entrepreneurial potential and the effective indicator of net income from the sale of products (goods, works, services) of the studied economic entities for the next year 2025 (table 5).

**Table 5. Forecasting of the social and technological factors of the quality of ecological products and the sustainable development of the entrepreneurial potential of five innovative eco-projects, 2025**

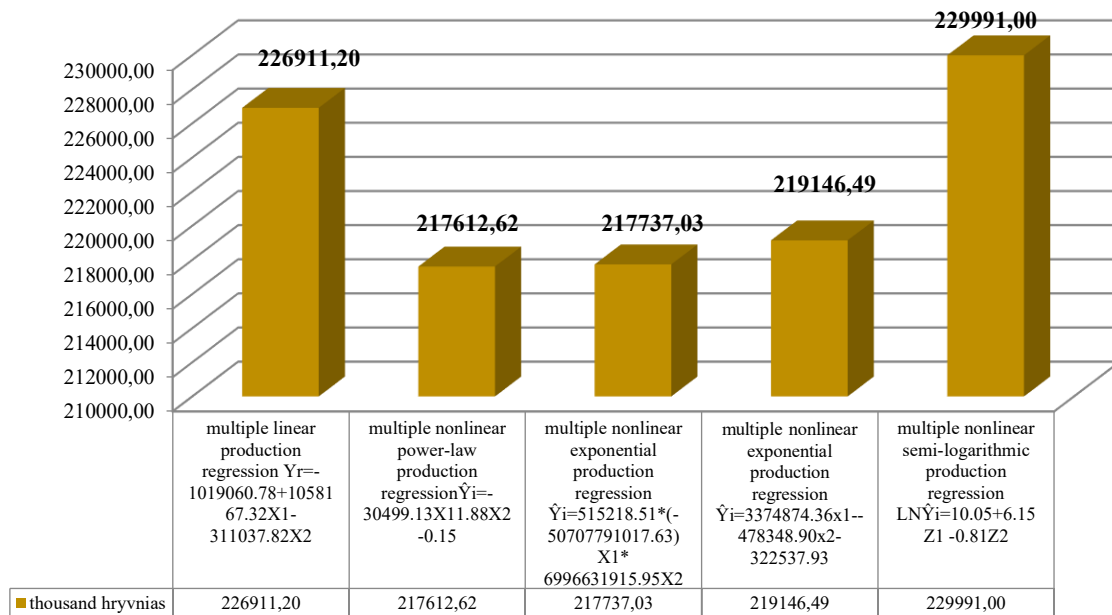
Business entity	Factors of influence (built-in TREND statistical function)			
	Social influencing factors quality of ecological products, X1	Characteristic	Technological factors of sustainable development of entrepreneurial potential, X2	Characteristic
“Organic Milk” LLC	1,42	growth on 0,05	0,64	growth on 0,01

“Danube Agrarian” LLC	1,37	growth on 0,04	0,56	growth on 0,01
“Stary Porytsk” LLC	1,31	growth on 0,02	0,63	growth on 0,01
LLC “Skyrsky Bread Products Factory”	1,47	growth on 0,12	0,67	growth on 0,02
PE “Company Molfar”	1,28	growth on 0,03	0,50	growth on 0,02

\*Source: suggested by the authors.

Analyzing the forecast data of the social and technological factors of the quality of ecological products and the sustainable development of the entrepreneurial potential of five innovative eco-projects, we observe their growth, which is a justified phenomenon in the activity and management of the efficiency of the functioning of an agrarian enterprise and can give a positive effect to the entire production and economic activity and financial result. Analysis of net income forecasting for five innovative

eco-projects for 2025 using different types of production regressions shows differences in the impact of social and technological factors on profitability. Next, we forecast the effective indicator of net income from the sale of products (goods, works, services) of five innovative eco-projects for the next year 2025 using five production regressions of a linear and non-linear nature: linear, power, exponential, exponential and semi-logarithmic (Fig. 1-5).



**Figure 1. Forecast values of net income from the sale of products (goods, works, services) of LLC “Organic Milk” using linear and non-linear production regressions, 2025**

\*Source: calculated by the authors.

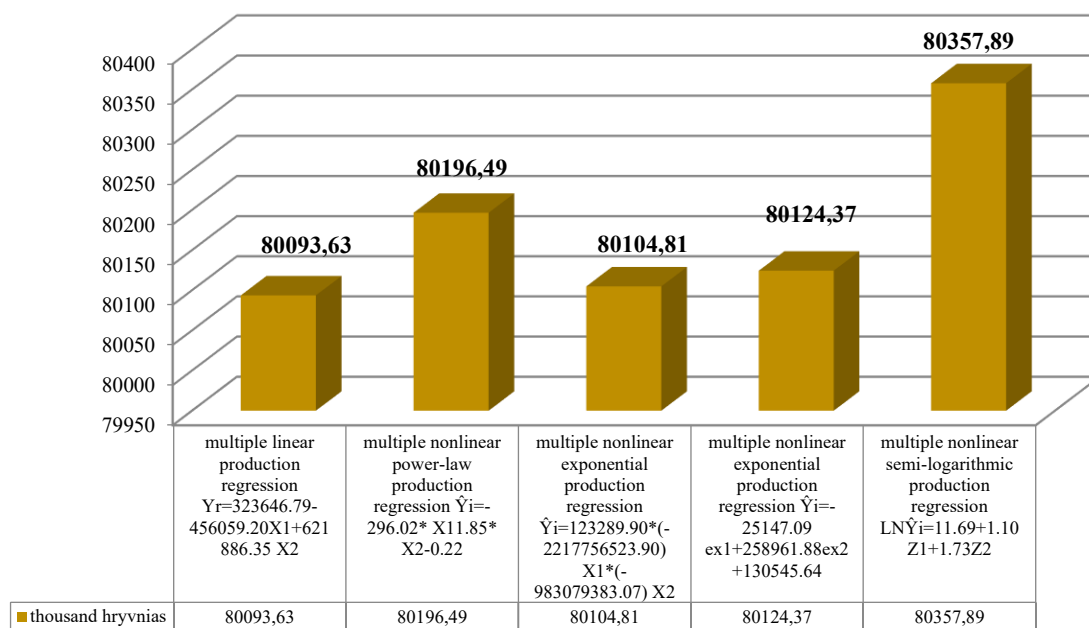


Figure 2. Projected values of net income from the sale of products (goods, works, services) LLC “Danuysky Agrarian” using linear and non-linear production regressions, 2025

\*Source: calculated by the authors.

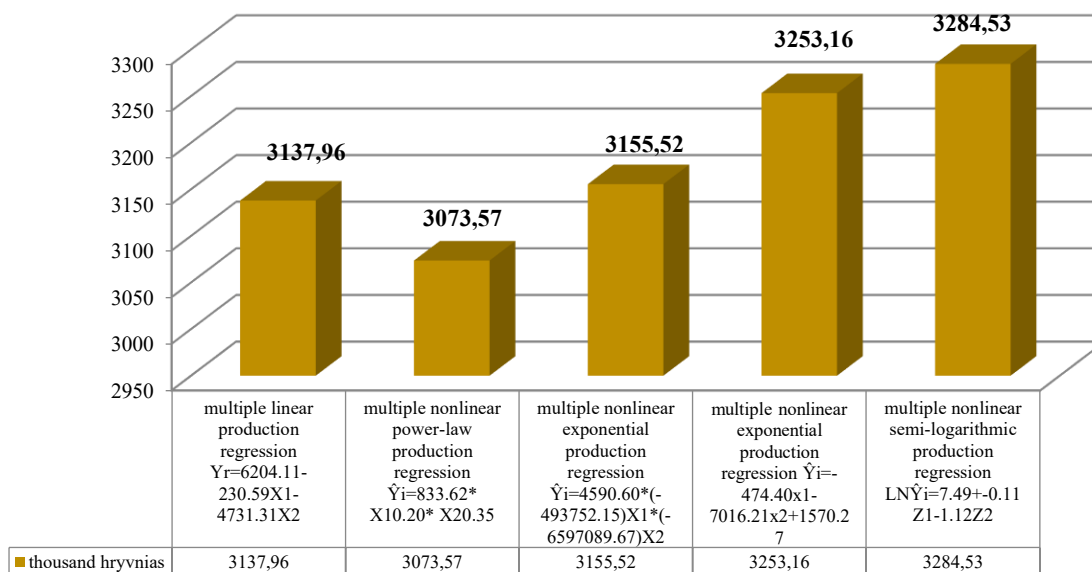
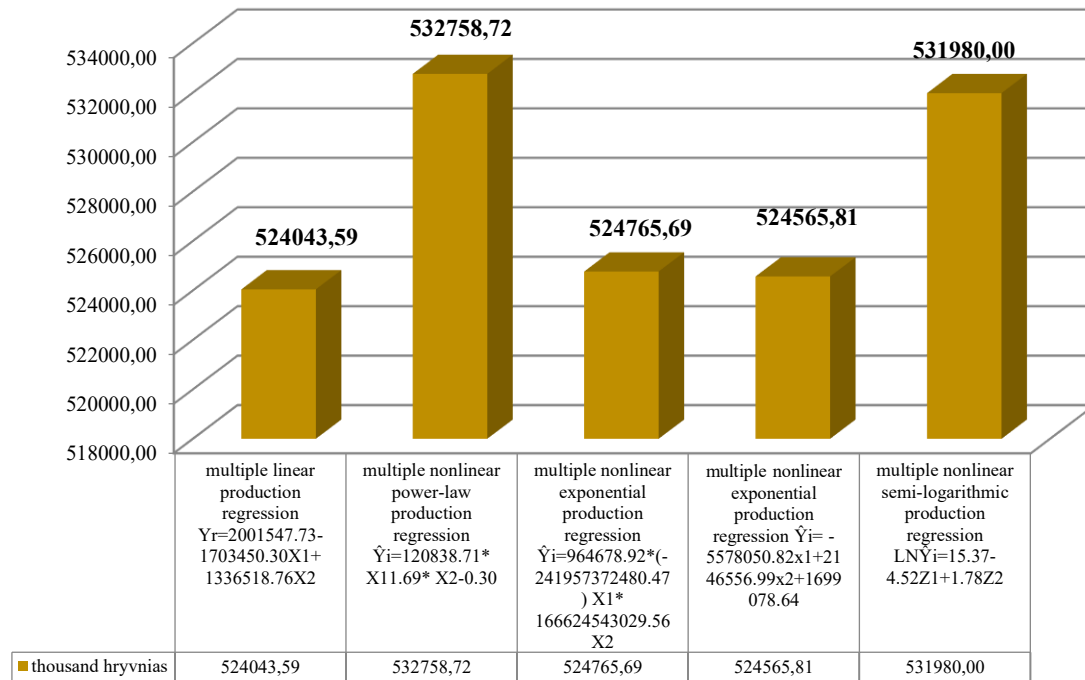


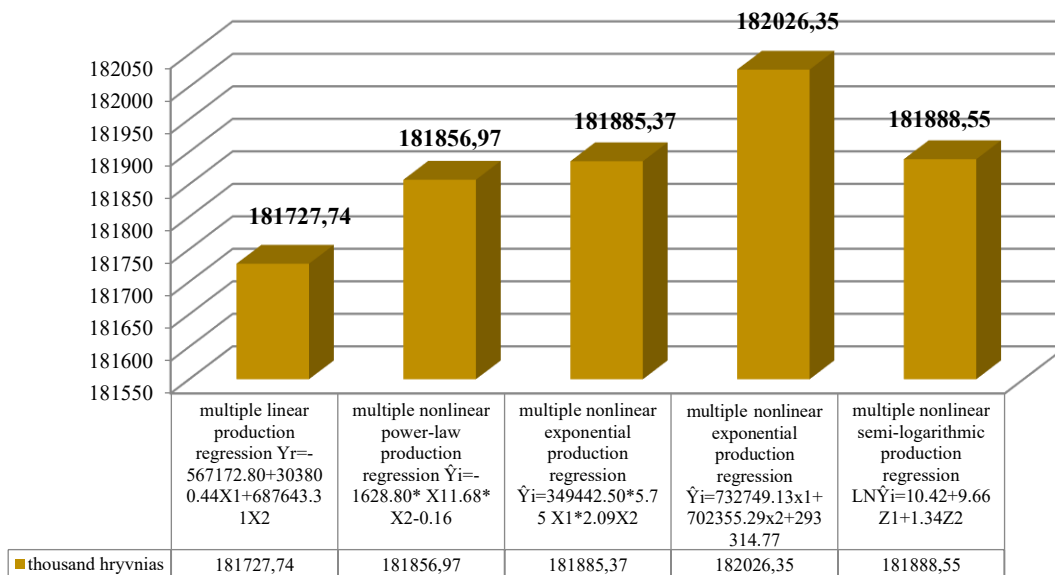
Figure 3. Projected values of net income from the sale of products (goods, works, services) of “Stary Porytsk” LLC using linear and non-linear production regressions, 2025

\*Source: calculated by the authors.



**Figure 4. Forecast values of net income from the sale of products (goods, works, services) LLC “Skyrskiy kombinat hliboproduktiv” using linear and non-linear production regressions, 2025**

\*Source: calculated by the authors.



**Figure 5. Forecast values of net income from the sale of products (goods, works, services) of PE “Company Molfar” using linear and non-linear production regressions, 2025**

\*Source: calculated by the authors.

Thus, the results show that for most enterprises the greatest increase in net sales revenue is observed when using the semi-logarithmic model, which may indicate that the

influence of social and technological factors is becoming more effective in the form of moderately growing but gradual changes.

## Conclusions

The obtained results are significant for the innovative management of quality eco-projects and the sustainable development of entrepreneurial potential, as they reflect the dependence of the net income of enterprises on social and technological factors. Different types of regressions (linear and non-linear) allow us to analyze how certain point estimates of factors of environmental product quality and sustainable development affect profitability, demonstrating the strength and nature of these effects. For integrated structures applying smart technologies in the informational bio-economy, the obtained results emphasize the importance of accurate forecasting of the economic efficiency

of innovative projects. For example, regression models make it possible to assess how effective the implementation of certain technological solutions and social innovations is in achieving sustainable development. In particular, the semi-logarithmic model demonstrates significant advantages in forecasting, where the dependence of net income on socio-technological changes becomes more obvious and can be traced more clearly. The use of such forecasts in the context of bioeconomy and smart technologies makes it possible to adapt management decisions, improving the quality and efficiency of management of eco-projects, which can help optimize resources, increase revenues and make enterprises more competitive.

## References

- [1] Aranchiy, V., Ganushchak-Efimenko, L., Khrystenko, L., Shkoda, M., Hnatenko, I., & Fastovets, N. (2022). Modeling of integrated assessment of the effectiveness of management of the financial position of business entities. *Financial and Credit Activity Problems of Theory and Practice*, 1(42), 259-270.
- [2] Atamanenko Y., Komchatnykh O., Sukhomlyn L., Didkivskiy V., Sulym B., & Losheniuk O. (2021) The Importance of International Transport and Logistics Infrastructure in the Economic Development of the Country: The Case of the EU for Ukraine. *International Journal of Computer Science and Network Security*, 21(3), 198–205.
- [3] Balanovska T., Gogulya O., Dramaretska K., Voskolupov V., & Holik V. (2021). Using marketing management to ensure competitiveness of agricultural enterprises. *Agricultural and Resource Economics: International Scientific E-Journal*, 7 (3), 142-161.
- [4] Balanovska, T., Gogulya, O., & Wyrzykowska, B. (2018). The role of entrepreneur competencies in the development of rural areas. *Economic Sciences for Agribusiness and Rural Economy*, (1), 55-61.
- [5] Balanovska, T., Gogulya, O., Zorgach, A., Havrysh, O., & Dramaretska, K. (2022). Development peculiarities of agrarian entrepreneurship in Ukraine. *Entrepreneurship and Sustainability Issues*, 10(2), 60-80.
- [6] Balanovska, T., Mykhailichenko M., Holik, V., Dramaretska, K., & Troian, A. (2021). Development management of agricultural enterprises. *Financial and Credit Activity: Problems of Theory and Practice*, 3(38), 134–143.
- [7] Bazeliuk, V., Kubitskyi, S., Rudyk, Y., Ryabova, Z., & Novak, O. (2021). The system of formation and diagnosis of levels of innovation and entrepreneurship competence of the future managers of education in the conditions of the knowledge economy. *Financial and credit activity problems of theory and practice*, 4(39), 550-558.
- [8] Bilan, Y., Zos-Kior, M., Nitsenko, V., Sinelnikau, U., & Ilin, V. (2017). Social Component in Sustainable Management of Land Resources. *Journal of Security and Sustainability Issues*, 7(2), 287-300.
- [9] Bosniuk, V., Ostopolets, I., Svitlychna, N., Miroshnichenko, O., Tsipan, T., & Kubitskyi, S. (2021). Social content of psychological specialists' professional activity. *Postmodern openings*, 12(1), 01-20.
- [10] Gryshchenko, I., Ganushchak-Efimenko, L., Hnatenko, I., & Rebilas, R. (2023). Management of environment design of the development of innovative entrepreneurship at integrated structures under the conditions of post-war reconstruction. *Financial & Credit Activity: Problems of Theory & Practice*, 4(52), 341.
- [11] Hryhoriv, Y., Butenko, A., Nechyporenko, V., Lyshenko, M., Ustik, T., Zubko, V., Makarenko, N. & Mushtai, V. (2021). Economic efficiency camelina growing with nutrition optimization under conditions of precarpathians of Ukraine. *Agraarteadus: Journal of Agricultural Science*, 32(2), 232-238.
- [12] Hryhoriv, Y., Nechyporenko, V., Butenko, A., Lyshenko, M., Kozak, M., Onoprienko, I., Shumkova, O., Shumkova Viktoriia & Kriuchko, L. (2022). Economic efficiency of sweet corn growing with nutrition optimization. *Agraarteadus: Journal of Agricultural Science*, 33(1).
- [13] Kraievskiy, V. M., Okhrimenko, I. V., Skoryk, M. O., Lysiuk, A. V., & Hmyrya, V. P. (2021). Analytical tools in ensuring the convergence of accounting and information systems. *Bulletin the National academy of sciences of the Republic of Kazakhstan*, (1), 163-169.
- [14] Kulinich, T., Berezina, L., Bahan, N., Vashchenko, I., & Hurievska, V. (2021). Application of project management: lean technologies and saving manufacturing (aspects of management and public administration). *International Journal of Computer Science & Network Security*, 21(5), 57-68.

- [15] 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).
- [16] Mykhailichenko, M., Lozhachevska, O., Smagin, V., Krasnoshtan, O., Zos-Kior, M., & Hnatenko, I. (2021). Competitive strategies of personnel management in business processes of agricultural enterprises focused on digitalization. *Management Theory and Studies for Rural Business and Infrastructure Development*, 43(3), 403–414.
- [17] Oseredchuk, O., Drachuk, I., Teslenko, V., Ushnevych, S., Dushechkina, N., Kubitskyi, S., & Chychuk, A. (2022). New Approaches to Quality Monitoring of Higher Education in the Process of Distance Learning. *IJCSNS International Journal of Computer Science and Network Security*, 22(7), 35-42.
- [18] Prokopenko, O., Martyn, O., Bilyk, O., Vivcharuk, O., Zos-Kior, M., & Hnatenko, I. (2021). Models of State Clusterisation Management, Marketing and Labour Market Management in Conditions of Globalization, Risk of Bankruptcy and Services Market Development. *International journal of computer science and network security: IJCSNS*, 21(12), 228-234.
- [19] Prylipko, S., Vasylieva, N., Kovalova, O., Kulayets, M., Bilous, Y., & Hnatenko, I. (2021). Modeling of Regional Management of Innovation Activity: Personnel Policy, Financial and Credit and Foreign Economic Activity. *International Journal of Computer Science & Network Security*, 21(11), 43-48.
- [20] Pryshliak N., Zdyrko N., Shynkovych A., Koval N. (2022). The Study on Energy Independence (Autonomy) of an Agricultural Enterprise Assurance. *TEM Journal*, 11 (1), 403–410.
- [21] Purdenko, O., Artyushok, K., Riazanova, N., Babaiev, I., Kononenko, A., Lepeyko, T., & Zos-Kior, M. (2023). Financial management of innovative eco-entrepreneurship. *Management Theory and Studies for Rural Business and Infrastructure Development*, 45(2), 152-165.
- [22] Raskin, L., Sira, O., Sukhomlyn, L., & Bachkir, I. (2017). Symmetrical criterion of random distribution discrimination. In *2017 International Conference on Modern Electrical and Energy Systems (MEES)* (pp. 320-323). IEEE.
- [23] Semenov, A., Kuksa, I., Hnatenko, I., Sazonova, T., Babiy, L., & Rubezhanska, V. (2021). Management of Energy and Resource-Saving Innovation Projects at Agri-Food Enterprises. *TEM Journal*, 10(2).
- [24] Sylkin, O., Bosak, I., Homolska, V., Okhrimenko, I., & Andrushkiv, R. (2021). Intensification of management of economic security of the enterprise in the post-pandemic space. *Postmodern Openings*, 12(1Sup1), 302-312.
- [25] Voznyuk, A. V., Kubitskyi, S. O., Balanovska, T. I., Dorofyeyev, O. V., & Chip, L. O. (2022). Synergetic simulation of managing processes in educational sphere in the contest of temporary selfruled managerial target teams application. *Financial and Credit Activity Problems of Theory and Practice*, 3(44), 317-327.
- [26] Voznyuk, A., Gorobets, S., Kubitskyi, S., Domina, V., Gutareva, N., Roganov, M., & Bloshchynskyi, I. (2021). Interdisciplinary Educational Technology based on the Concept of Human Brain Functional Asymmetry . *Postmodern Openings*, 12(2), 433-449.
- [27] Zhyvko, Z., Morhachov, I., Zhelikhovska, M., Artiukh-Pasiuta, O., Hnatenko, I., Skrypnyk, V., & Yanechko, S. (2024). The Influence of the US Stock Market on the Institutional Security Strategy of the Management of Innovative Development. *Management Theory and Studies for Rural Business and Infrastructure Development*, 46(1), 104-111.
- [28] Zos-Kior, M., Kuksa, I., Iliin, V., & Chaikina, A. (2016). Land management prospects. *Economic Annals-XXI*, (161), 43-46.
- [29] Zos-Kior, M., Kuksa, I., Samoilyk, I., & Storoška, M. (2017). Methodology for assessing globalisation development of countries. *Economic annals-XXI*, (168), 4-8.