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MODELLING OF ORGANIZATIONAL AND MANAGERIAL SECURITY OF FINANCIAL AND PERSONNEL SUPPORT OF INNOVATIVE AGRIBUSINESS

ABSTRACT

The topic of the article is aimed at researching the impact of organizational and management decisions on the stability of agricultural enterprises in the conditions of innovative activity. The article focuses on the relationship between personnel security and financial stability, using mathematical models to assess risks and optimize management processes. The article defines the need for modelling the organizational and managerial security of financial and personnel support of innovative agro-entrepreneurship. It is proposed to use non-linear economic and mathematical models for such modelling, which allow a deeper understanding of the interrelationships between various factors affecting the activities of enterprises. It was determined that such models allow a better understanding of how changes in one sector affect others and provide an opportunity to develop strategies that reduce risks and increase the sustainability of the enterprise. Our proposed method of modelling the organizational and managerial security of financial and personnel support of innovative agro-entrepreneurship is adapted on the example of PE "named after Kalashnyk" of Poltava district; Sub-division of the State Enterprise "Stepne" of the Poltava District; LLC "Agro-Osnova" of the Kirovohrad Region; LLC "Agrarian Company "Zorya" of Kirovohrad region; "Agromaster" gas station of Dnipropetrovsk region; LLC Agrofirma "Kolos" of Dnipropetrovsk region. As a result of modelling the forecasting of organizational and managerial security of financial and personnel support of innovative agribusiness, it was determined that the relationship between personnel and financial security varies depending on the enterprise. In some cases, staff security is a key factor in financial stability, while in others its impact is limited. The proposed modelling technique will be useful in the system of management planning and financial policy for domestic agricultural enterprises that strive for innovative development and are concerned about ensuring effective financial and personnel security.

Keywords: security, financial support, personnel support, innovative agribusiness, financial condition of enterprises, personnel management, personnel turnover

JEL Classification: Q14, O15, O31

INTRODUCTION

Modelling the organizational and managerial security of financial and personnel support of innovative agribusiness is a key area of research aimed at ensuring the stable development of agrarian enterprises in the conditions of modern challenges. This approach is based on a deep analysis of the relationship between personnel security, financial stability and innovative activity of the enterprise. Organizational and managerial security involves effective management of resources and processes that ensure the company's resilience to internal and external threats. Financial support is one of the fundamental elements that determines the stability of the enterprise on the market. Managers of agricultural enterprises must make informed decisions about investing in new technologies and projects, as well as have a clear idea of possible risks. At the same time, personnel support plays an equally important role, since qualified personnel are the basis of the effective operation of the enterprise. Underestimation of personnel potential

can lead to a decrease in productivity and negative financial results. Modelling this process includes the use of various mathematical methods, such as non-linear regressions and econometric models, which allow for predicting the impact of personnel changes on financial indicators. Such models make it possible to identify critical moments when ineffective management of resources can lead to financial instability or loss of competitive advantages. With the help of these tools, agricultural enterprises can optimize their development strategies, responding in time to market challenges. Thus, modelling the organizational and managerial security of financial and personnel support of innovative agribusiness allows agribusiness to reduce risks, and increase efficiency and sustainability in a changing environment.

LITERATURE REVIEW

The literature review on the topic of the article covers a wide range of research in the fields of agribusiness, personnel management, financial planning and innovative technologies. A significant number of scientific works are devoted to issues of financial risk management and increasing the sustainability of agricultural enterprises in unstable market conditions.

Scholars (Kelly et al., 2003) have proposed effective means of increasing access to agricultural resources in Africa and proposed management methods to improve the African agricultural sector. In a scientific source (Xie and Huang, 2021), modern approaches to the analysis of factors affecting the implementation of pro-environmental agricultural technologies by farmers in China are considered. Scientists (Valenti et al., 2018) have developed a portfolio of quantitative indicators of economic, environmental and social sustainability to assess different aquaculture systems. They make it possible to carry out diagnostics, identify strengths and weaknesses, set goals, determine actions, and evaluate the effectiveness of actions and state policies. Scientists (Kabunga et al., 2014) determined in depth the impact of banana cultivation technology on household income and food security in Kenya. Interesting research by the authors (Boso et al., 2017), where the reasons for insufficient financial resources to ensure the sustainable development of developing small and medium-sized businesses are determined. Using the example of Niger agricultural firms, the authors showed how important resources are for the innovative development of companies. The scientific study (Pardey et al., 2010) details the issues of introducing innovations in the process of technological changes in forestry. The authors at a high level defined the prospects for the development of agriculture, which will improve their security in conditions of variability. Important in our article is the scientific work (Zolkover and Ovcharenko, 2024), where modelling of a comprehensive assessment of the level of innovation security, which is necessary for the identification and management of risks associated with the introduction of new technologies, is proposed. This allows organizations or countries to assess potential threats related to innovation and make decisions to minimize them, ensuring stable development and competitiveness in the market.

The conceptual foundations of scientific teachings (Zhyvko et al., 2022) are used in our scientific work. Thus, the security of digitization in the management accounting and finances of the subject of the national economy is critically important in the conditions of globalization, as it provides protection against cyber threats, helps preserve data confidentiality and maintains the stability of economic processes. This allows you to effectively manage financial resources and make informed decisions, minimizing risks and losses associated with digital transformations. The analysis of the marketing of professional farmers' cooperatives in China (Xiangping et al., 2012) is related to the modelling of organizational and managerial security of innovative agribusiness due to the need for effective resource management and ensuring financial and personnel stability. Both processes are aimed at increasing competitiveness and adapting to rapid changes in the agri-food market, which requires an innovative approach to product management and promotion. Therefore, this scientific work is also important in our article.

Agricultural biotechnologies in developing countries are related to the modelling of organizational and managerial security of innovative agribusiness through their common goal of ensuring food security. The positioning of business systems for the production of organic products in the conditions of globalization and an innovative economy (Varaksina et al., 2022) is related to the modelling of organizational and managerial security of innovative agribusiness since both approaches are aimed at increasing the competitiveness and sustainability of agribusinesses. This includes effective management of resources, finances and personnel for successful functioning in the conditions of dynamic market changes and growing demand for organic products.

Modelling the organizational and managerial security of agribusiness is related to the sustainable development of regions and modelling the management of economic security of innovative entrepreneurship (Khodakivska et al., 2022) through joint mechanisms for ensuring sustainability and protecting resources. Both approaches are aimed at optimizing the management of finances and personnel, which are key to the development of innovative enterprises and ensuring the economic security of regions.

The topic of our paper is closely related to economic concerns and security threats on farms due to the need for effective resource management to minimize risks (Hagel et al., 2013). This includes financial and personnel solutions aimed at protecting farms from external and internal threats affecting their stability and productivity. Forecasting current assets of enterprises to support financial and economic security and prevent bankruptcy (Mihus and Zaiets, 2024) is related to the modelling of organizational and management security of agribusiness since both processes are aimed at ensuring stability and effective management of resources. This helps to optimize financial flows, minimize risks and maintain the stability of enterprises in conditions of market instability.

The state of occupational health and safety in a growing economy is related to modelling the organizational and managerial safety of agribusiness due to the need to ensure safe working conditions and human resources management (Mrema et al., 2015). This is important for maintaining the productivity and sustainability of agricultural enterprises, which is especially relevant in the conditions of the development of innovative industries. State regulation of employment in the labour market of territorial communities in the conditions of innovative development of entrepreneurship (Vasylchak et al., 2022), connected with the modelling of organizational and managerial security of agribusiness due to the need for effective personnel management. Both processes are aimed at ensuring the stability of employment and supporting the innovative development of enterprises in response to changes in the economy and the labour market.

Important for our analysis is the work (Akhromkin et al., 2024), which depicts economic integration and cooperation in the context of globalization. Such cooperation will allow to synergistically combine financial and personnel resources to improve the work of innovative agribusiness in a changing environment and in the conditions of globalization of agricultural markets. Actual questions are raised in the article (Vermeulen et al., 2012), where scientists deeply determined why climate change affects the change in agriculture and food security using the example of low-income agricultural producers.

Scientists (Kubitskyi et al., 2024) determined the assessment of the impact of innovative technologies on global competitiveness through modelling at a thorough level. Moreover, the system of combining the main indicators in the process of such modelling is implemented in our article. Foreign authors (Tang and Sun, 2022) proposed non-standard fiscal incentives, and financial support for agriculture and specified the causes of inequality between the city and the countryside. The specified conclusions in the article prove their fundamental importance for the formation of modelling of organizational and management security.

Scientists (Ovcharenko et al., 2022) prove the feasibility of forming ecoclusters in the process of managing enterprises, which are important for the financial and personnel support of innovative agribusiness. Clusters undoubtedly contribute to the formation of effective management of agricultural enterprises in the conditions of the crisis in which enterprises of Ukraine are now. Fundamental studies of the agri-food industry are conducted by scientists (Markina et al., 2022), where scientists prove the need for the formation of a balanced policy for the formation of an effective financial and personnel strategy in the conditions of the changing external environment of agribusiness. Studies quantifying the trade impact of European food safety standards on African exports are interesting (Otsuki et al., 2001). The importance of these studies for maintaining the safety of agricultural enterprises in the process of implementing export-import operations is indisputable.

The author's study (Chen et al., 2017) is very important, which examines the processes of agricultural production, total pollution or industrial emissions, and the principles of equilibrium price formation, consumer and producer surplus, state budget and social security are considered on this basis. The fundamental principles of improving the safety and quality of production are highlighted in the work (Kyryliuk et al., 2021). Using the example of animal husbandry products, the authors describe the principles, functions and methods of improving the security of business entities and cite organizational and economic factors for improving the efficiency of agricultural enterprises.

The reduction of agricultural emissions into the environment is depicted in the paper (Elahi et al., 2022). Using the example of Pakistani enterprises, scientists prove that it is impossible to increase the personnel and financial security of enterprises, disregarding the environmentalization of production. The positioning of business systems for the production of organic products in the conditions of globalization and innovative economy is related to the modelling of organizational and managerial security of agribusiness due to the need to ensure financial and personnel stability (Varaksina et al., 2022). This allows to effectively implement innovations, adapt to global market requirements and maintain the competitiveness of organic producers.

Interesting studies by the authors (Zhang et al., 2020) and (Dessein et al., 2013), where the main proposals for the financial and personnel development of agricultural enterprises during times of instability and dynamic changes are identified. The use of genetic technologies can increase the productivity and sustainability of agricultural enterprises, which requires appropriate financial and personnel support (Saienko et al., 2023). That is why the topic of polymorphism analysis

and the development of a molecular genetic system of genotyping for the telomerase reverse transcriptase gene is related to the modelling of organizational and managerial security of agribusiness due to the impact of biotechnological innovations on the efficiency of resource management.

Modelling of the organizational and managerial security of financial and personnel support of innovative agribusiness is related to the role of the agri-food industry in ensuring the economic security of Ukraine since the stability and development of this industry contribute to the economic stability of the country (Mostenska et al., 2024). Effective resource management in the agricultural sector is key to national economic security.

The topic of our article is related to the research of the authors (Alekseieva et al., 2024). due to the need for efficient use of resources, modernization of management and introduction of technologies to increase the sustainability and productivity of the agricultural sector. Scientists (Martinez and Poole, 2004) and (Savadogo et al., 1998) investigated a very relevant issue. The development of private fresh produce safety standards and the introduction of improved land use technologies to improve food security in Burkina Faso are related to modelling the organizational and managerial security of agribusiness due to the need to ensure effective resource management and compliance with standards. Both approaches are aimed at improving the quality, sustainability and safety of agricultural products, which requires financial and personnel stability of enterprises. Successful restructuring and new strategies, as in the case of almond cultivation, require financial and personnel sustainability to increase market competitiveness (Lutsiak et al., 2023; Mostenska et al., 2021).

The stages of enterprise restructuring in Ukraine and the innovative strategy of almond cultivation are related to the modelling of organizational and managerial security of agribusiness due to the need for adaptation to new conditions, effective management of resources and the introduction of innovations. The future of small farms and the modelling of organizational and managerial security of agribusiness are linked by the need to support the sustainability and development of small farms (Hazell et al., 2010). Effective financial and human resources management allow small farms to adapt to changing policy and market conditions, innovate and secure their competitive future. Scientific works are important (Korobenko et al., 2021; Abuselidze et al., 2022). In particular, the role of local governments in shaping the economic potential of rural areas in conditions of decentralization and the use of hedge technologies to minimize price risks are related to the modelling of organizational and managerial security of agribusiness through the common goal of ensuring financial stability.

Local governance promotes infrastructure development and agribusiness support, while hedging helps reduce risks, which strengthens the economic security of businesses. The pandemic has shown the importance of managing financial and human resources for the sustainability of agribusinesses, which reflects the key principles of modelling security in the face of unpredictable threats (Boughton et al., 2021). The impact of COVID-19 on agricultural production and food systems in Southeast Asian countries such as Myanmar is related to modelling the organizational and managerial security of agribusiness due to the need to adapt to crisis conditions.

Thus, the review of the literature indicates the multifaceted approaches to ensuring the organizational and managerial security of innovative agricultural enterprises. All aspects — from financial forecasts to personnel management — must be integrated into the development strategy to achieve stability and competitiveness in the agricultural sector.

AIMS AND OBJECTIVES

The purpose of the article is to implement the process of modelling the organizational and managerial security of financial and personnel support of innovative agro-entrepreneurship.

The objectives of the article are:

- study of the impact of human resources on the financial stability of agricultural enterprises and vice versa;
- development of mathematical models for assessing the relationship between financial and personnel security;
- modelling of forecasting organizational and managerial security of financial and personnel support of innovative agribusiness;
- detailing the phasing of assessing the effectiveness of organizational and managerial security and the interaction of financial security and personnel security of innovative agribusiness;
- comparison of security modelling systems for financial and personnel support of innovative agro-entrepreneurship.

METHODS

Modelling organizational and managerial security of financial and personnel support of innovative agribusiness is a key element for achieving stability and efficiency in the agricultural industry. The use of non-linear economic and mathematical models allows for a deeper understanding of the relationships between various factors affecting the activities of enterprises. They allow a better understanding of how changes in one sector affect others and provide an opportunity to develop strategies that reduce risks and increase the sustainability of the enterprise. Thanks to such models, it is possible to create more effective resource management systems, adapting to rapid changes in the economic environment and increasing competitiveness. Thanks to such models, it is possible to analyze and predict the impact of investments, financial risks and personnel policies on the overall efficiency of the enterprise, taking into account the complex nature of these processes. They make it possible to optimize the allocation of resources, ensure stability and predict the dynamics of the company's development in conditions of uncertainty, which is especially important for agricultural enterprises operating in an innovative environment. As an assessment of the quality of management and modelling of organizational and managerial security, in particular, the financial security of innovative agricultural enterprises, financial coefficients of activity can act, namely some of them - the coefficient of absolute liquidity (solvency), the coefficient of financial stability, the coefficient of financial autonomy, the coefficient of financial dependence, the adequacy ratio of fixed assets and the level of profitability of sales. Regarding personnel provision of innovative agribusiness in the management system and modelling of organizational and managerial security of the enterprise, the personnel management process consists of indicators and coefficients characterizing its effectiveness both at this level and at the level of the entire business entity: staff turnover rate; staff profitability; coefficient of staff permanence; personnel adaptation factor; staff seasonality factor. The database consists of innovatively active agrarian enterprises of the central region of Ukraine, which are characterized by agricultural lands of similar size, used for growing strategically important and ecologically clean agricultural crops. Such enterprises not only adhere to high standards of environmental safety in their activities but also actively implement innovative approaches to increase productivity and production efficiency. The implementation of innovative solutions includes, in particular, the modernization of agricultural machinery and technological processes, as well as the renewal of crop varieties to increase yield and resistance to external factors. Our chosen companies demonstrate high-efficiency thanks to their strategic approach to resource management, which allows them to remain profitable even in volatile market conditions. Their innovative activity contributes to the stable growth and development not only of the farms themselves but also of the entire region. They are an example of successful agribusinesses that combine innovation with traditional agriculture, ensuring stable income and growing economic activity in the agricultural sector. So, the financial and economic activity of agricultural enterprises served as an information source: PE "named after Kalashnyk" of Poltava district; Sub-division of the State Enterprise "Stepne" of the Poltava District; LLC "Agro-Osnova" of Kirovohrad region; LLC "Agrarian company "Zorya" of Kirovohrad region; "Agromaster" gas station of Dnipropetrovsk region; LLC Agrofirma "Kolos" of the Dnipropetrovsk region (<https://tripoli.land/ua/farmers/>). The basis for the analysis is a complex indicator of financial security and a complex indicator of personnel security of six domestic innovative agricultural enterprises over the last decade. It should be noted that the main coefficients of the financial condition and security of the enterprise were used to determine the comprehensive indicator of the financial security of domestic agricultural enterprises: the coefficient of absolute liquidity (solvency), the coefficient of adequacy of fixed assets, the coefficient of financial stability, the coefficient of financial autonomy and the level of profitability of sales (Table 1).

Table 1. Dynamics of the complex indicator of financial security of six domestic innovative agricultural enterprises, 2014-2023. (Source: developed by the authors taking into account <https://tripoli.land/ua/farmers/>)

The name of the indicator	Conventional designation	The specific gravity of the indicator	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
PP "named after Kalashnikov" of the Poltava district												
The coefficient of absolute liquidity (payment capacity)	P1	0.20	0.40	0.33	0.26	0.29	0.22	0.28	0.21	0.28	0.25	0.26
The adequacy ratio of fixed assets	P2	0.20	0.85	1.10	1.05	1.02	1.00	1.66	1.49	1.59	1.70	1.81
Coefficient of financial stability	P3	0.20	1.04	1.08	1.00	1.17	1.14	1.12	1.17	1.19	1.21	1.23
Coefficient of financial autonomy	P4	0.20	1.06	1.08	1.00	1.04	1.03	1.03	1.02	1.01	1.00	0.99
The level of profitability of sales, %	P5	0.20	2.57	3.21	3.93	5.78	7.19	1.00	5.19	1.44	1.36	1.32
The average value of the indicator			1.18	1.36	1.45	1.86	2.12	1.02	1.81	1.10	1.10	1.12
SE «Stepne» Poltava district												
The coefficient of absolute liquidity (payment capacity)	P1	0.20	0.44	0.46	0.36	0.29	0.25	0.28	0.22	0.25	0.21	0.27
The adequacy ratio of fixed assets	P2	0.20	0.99	1.16	1.33	1.50	1.67	1.84	2.01	2.18	2.35	2.52
Coefficient of financial stability	P3	0.20	1.44	1.48	1.50	1.53	1.56	1.59	1.62	1.65	1.68	1.71
Coefficient of financial autonomy	P4	0.20	1.32	1.28	1.14	1.07	1.98	1.89	1.80	1.86	2.05	2.17
The level of profitability of sales, %	P5	0.20	3.04	3.16	3.28	3.40	3.52	4.06	4.04	4.44	4.34	4.58
The average value of the indicator			1.45	1.51	1.52	1.56	1.80	1.93	1.94	2.08	2.13	2.25
LLC «Agro-Osvana» of the Kirovohrad region												
The coefficient of absolute liquidity (payment capacity)	P1	0.20	0.64	0.67	0.60	0.64	0.68	0.60	0.62	0.69	0.74	0.78
The adequacy ratio of fixed assets	P2	0.20	0.97	1.06	1.03	1.08	1.11	1.14	1.17	1.20	1.23	1.26
Coefficient of financial stability	P3	0.20	1.48	1.53	1.50	1.52	1.55	1.49	1.53	1.53	1.53	1.54
Coefficient of financial autonomy	P4	0.20	1.14	1.19	1.15	1.19	1.18	1.18	1.09	1.16	1.14	1.18
The level of profitability of sales, %	P5	0.20	5.04	5.16	5.18	4.40	4.47	4.28	4.09	3.90	3.71	3.77
The average value of the indicator			1.85	2.24	1.89	1.77	2.08	1.74	1.70	1.95	1.67	1.71
LLC «Agrarian company «Zorya» of Kirovohrad region												
The coefficient of absolute liquidity (payment capacity)	P1	0.20	0.78	0.77	0.70	0.74	0.78	0.78	0.62	0.69	0.68	0.71
The adequacy ratio of fixed assets	P2	0.20	1.28	1.44	1.60	1.76	1.92	2.08	2.24	2.40	2.56	2.72
Coefficient of financial stability	P3	0.20	1.58	1.53	1.50	1.56	1.52	1.48	1.53	1.59	1.48	1.54
Coefficient of financial autonomy	P4	0.20	1.16	1.19	1.22	1.25	1.28	1.31	1.34	1.37	1.40	1.43
The level of profitability of sales, %	P5	0.20	6.12	6.16	6.18	5.40	5.47	5.28	5.06	4.86	4.66	4.98
The average value of the indicator			2.18	2.22	2.24	2.14	2.19	2.19	2.16	2.56	2.16	2.28
ALLC «Agromaster» of Dnipropetrovsk region												
The coefficient of absolute liquidity (payment capacity)	P1	0.20	0.95	0.97	0.90	0.94	0.98	0.98	0.82	0.89	0.80	0.91
The adequacy ratio of fixed assets	P2	0.20	2.85	2.44	2.60	2.76	2.92	2.88	2.94	3.02	2.89	3.04
Coefficient of financial stability	P3	0.20	1.64	1.63	1.60	1.66	1.62	1.68	1.63	1.59	1.60	1.64
Coefficient of financial autonomy	P4	0.20	1.24	1.29	1.22	1.24	1.28	1.31	1.30	1.35	1.30	1.34
The level of profitability of sales, %	P5	0.20	5.99	6.10	6.20	6.40	6.46	6.28	6.06	6.86	6.63	6.70
The average value of the indicator			2.53	2.49	2.50	2.60	2.65	2.63	2.55	2.74	2.64	2.72
LLC Agrofirma "Kolos" of Dnipropetrovsk region												
The coefficient of absolute liquidity (payment capacity)	P1	0.20	1.22	1.29	1.70	1.74	1.78	1.78	1.62	1.69	1.80	1.71
The adequacy ratio of fixed assets	P2	0.20	2.06	2.04	2.60	2.76	2.92	2.88	2.84	2.64	2.56	2.74
Coefficient of financial stability	P3	0.20	0.98	0.78	0.70	0.54	0.55	0.56	0.72	0.88	0.64	0.77
Coefficient of financial autonomy	P4	0.20	2.33	2.39	2.33	2.25	2.28	2.31	2.34	2.37	2.34	2.53
The level of profitability of sales, %	P5	0.20	4.22	4.15	4.18	4.24	4.22	4.10	4.26	4.17	4.04	4.22
The average value of the indicator			2.16	2.13	2.30	2.31	2.35	2.33	2.36	2.35	2.28	2.39

It should be noted that the comprehensive indicator of financial security is the average value of the presented coefficients of the company's financial condition. The author chose the most significant financial ratios that characterize the state and security of an agricultural entity. The calculated financial coefficients are within the normative value, that is, the researched innovative agrarian enterprises are stable and efficient. The specific weight of each financial ratio is 20% of the total structural value. Next, we will examine the dynamics of the defined complex indicator of staffing security of six domestic innovative agricultural enterprises over the last decade. To determine the comprehensive indicator of personnel security of domestic agricultural enterprises, the main personnel management coefficients were used: personnel turnover ratio, personnel profitability, personnel stability ratio, personnel adaptation ratio, and personnel seasonality ratio, which were described and characterized previously (Table 2).

Table 2. Dynamics of the complex indicator of personnel security of six domestic innovative agricultural enterprises, 2014-2023.
 (Source: developed by the authors taking into account <https://tripoli.land.ua/farmers/>)

Name of the indicator	Conventional designation	Specific weight of the indicator	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
PP "named after Kalashnikov" of the Poltava district												
Staff turnover rate	P1	0.20	0.83	1.00	1.00	1.20	1.26	1.45	1.53	1.65	1.76	1.88
Profitability of personnel	P2	0.20	2.24	3.14	3.02	2.90	2.78	2.66	2.64	2.72	2.30	2.38
Staff retention rate	P3	0.20	0.75	0.66	0.67	0.68	0.72	0.73	0.76	0.62	0.69	0.74
Staff adaptation factor	P4	0.20	0.60	0.65	0.68	0.72	0.76	0.80	0.84	0.88	0.92	0.96
Staff seasonality factor	P5	0.20	0.54	0.46	0.38	0.42	0.46	0.39	0.37	0.35	0.33	0.38
The average value of the indicator			0.99	1.18	1.15	1.18	1.20	1.21	1.23	1.24	1.20	1.27
SE «Stepne» Poltava district												
Staff turnover rate	P1	0.20	1.09	1.20	1.31	1.32	1.36	1.45	1.52	1.59	1.65	1.60
Profitability of personnel	P2	0.20	4.05	4.14	4.23	4.32	4.41	4.50	4.59	4.68	4.36	4.44
Staff retention rate	P3	0.20	0.45	0.48	0.47	0.49	0.52	0.56	0.48	0.54	0.49	0.50
Staff adaptation factor	P4	0.20	0.62	0.60	0.68	0.69	0.72	0.75	0.78	0.81	0.84	0.87
Staff seasonality factor	P5	0.20	0.56	0.48	0.40	0.32	0.44	0.32	0.28	0.34	0.32	0.35
The average value of the indicator			1.35	1.38	1.42	1.43	1.49	1.52	1.53	1.59	1.53	1.55
LLC «Agro-Osvana» of the Kirovohrad region												
Staff turnover rate	P1	0.20	2.45	2.20	2.31	2.32	2.36	2.45	2.52	2.59	2.65	2.60
Profitability of personnel	P2	0.20	3.05	3.14	3.23	3.32	3.41	3.50	3.59	3.58	3.56	3.73
Staff retention rate	P3	0.20	0.55	0.58	0.57	0.59	0.52	0.66	0.58	0.60	0.59	0.62
Staff adaptation factor	P4	0.20	0.74	0.70	0.78	0.79	0.72	0.75	0.78	0.81	0.79	0.83
Staff seasonality factor	P5	0.20	0.66	0.68	0.60	0.62	0.64	0.62	0.68	0.64	0.60	0.63
The average value of the indicator			1.49	1.46	1.50	1.53	1.53	1.60	1.63	1.64	1.64	1.68
LLC «Agrarian company «Zorya» of Kirovohrad region												
Staff turnover rate	P1	0.20	3.99	3.20	3.31	3.12	3.36	3.45	3.52	3.59	3.64	3.51
Profitability of personnel	P2	0.20	5.52	5.14	5.23	5.32	5.41	5.50	5.59	5.58	5.56	5.76
Staff retention rate	P3	0.20	2.55	2.58	2.57	2.59	2.57	2.66	2.58	2.60	2.62	2.57
Staff adaptation factor	P4	0.20	0.88	0.87	0.78	0.79	0.72	0.75	0.78	0.76	0.79	0.84
Staff seasonality factor	P5	0.20	0.89	0.88	0.86	0.82	0.84	0.82	0.88	0.83	0.80	0.82
The average value of the indicator			2.77	2.53	2.55	2.53	2.58	2.64	2.67	2.67	2.68	2.70
ALLC «Agromaster» of Dnipropetrovsk region												
Staff turnover rate	P1	0.20	4.09	4.20	4.31	4.13	4.36	4.45	4.52	4.59	4.64	4.51
Profitability of personnel	P2	0.20	6.52	6.18	6.26	6.06	5.93	5.80	5.67	5.54	5.41	5.36
Staff retention rate	P3	0.20	3.52	3.58	3.57	3.59	3.57	3.66	3.58	3.60	3.57	3.61
Staff adaptation factor	P4	0.20	0.94	0.87	0.88	0.79	0.72	0.68	0.63	0.58	0.53	0.68
Staff seasonality factor	P5	0.20	0.79	0.78	0.76	0.72	0.74	0.78	0.74	0.75	0.73	0.79
The average value of the indicator			3.17	3.12	3.16	3.06	3.06	3.07	3.03	3.01	2.98	2.99
LLC Agrofirma "Kolos" of Dnipropetrovsk region												
Staff turnover rate	P1	0.20	2.66	2.37	2.08	1.79	1.85	2.01	1.62	1.47	1.53	1.27
Profitability of personnel	P2	0.20	3.44	4.04	4.23	4.32	4.41	4.50	4.59	4.58	4.56	4.76
Staff retention rate	P3	0.20	3.05	3.18	3.15	3.23	3.28	3.33	3.38	3.43	3.48	3.53
Staff adaptation factor	P4	0.20	1.88	1.87	1.78	1.79	1.72	1.72	1.78	1.76	1.79	1.84
Staff seasonality factor	P5	0.20	0.78	0.72	0.76	0.82	0.78	0.72	0.87	0.83	0.80	0.82
The average value of the indicator			2.36	2.44	2.40	2.39	2.41	2.46	2.45	2.41	2.43	2.44

Just like the complex indicator of financial security, the complex indicator of personnel security is the average value of the presented personnel management coefficients. The author chose the most important personnel management coefficients of the enterprise, which characterize the personnel condition and safety of the agricultural entity. The calculated coefficients of personnel management are within the normative value, that is, the researched innovative agrarian enterprises are effectively managed and stable. The specific weight of each personnel management coefficient is 20% of the total structural value. Grouped and averaged for comparison, the complex indicator of financial security and the complex indicator of personnel security are presented in Table 3 and Figures 1-2.

Table 3. Dynamics of the complex indicator of financial security and the complex indicator of personnel security of six domestic innovative agricultural enterprises, 2014-2023. (Source: developed taking into account <https://tripoli.land/ua/farmers/>)

A comprehensive indicator of financial security											
Agricultural enterprises	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	On average for 2014-2023
PP "named after Kalashnikov" of the Poltava district	1.18	1.36	1.45	1.86	2.12	1.02	1.81	1.10	1.10	1.12	1.41
SE «Stepne» Poltava district	1.45	1.51	1.52	1.56	1.80	1.93	1.94	2.08	2.13	2.25	1.82
LLC «Agro-Osvana» of the Kirovohrad region	1.85	2.24	1.89	1.77	2.08	1.74	1.70	1.95	1.67	1.71	1.86
LLC «Agrarian company «Zorya» of Kirovohrad region	2.18	2.22	2.24	2.14	2.19	2.19	2.16	2.56	2.16	2.28	2.23
ALLC «Agromaster» of Dnipropetrovsk region	2.53	2.49	2.50	2.60	2.65	2.63	2.55	2.74	2.64	2.72	2.61
LLC Agrofirma «Kolos» of Dnipropetrovsk region	2.16	2.13	2.30	2.31	2.35	2.33	2.36	2.35	2.28	2.39	2.30
A comprehensive indicator of personnel security											
PP "named after Kalashnikov" of the Poltava district	0.99	1.18	1.15	1.18	1.20	1.21	1.23	1.24	1.20	1.27	1.19
SE «Stepne» Poltava district	1.35	1.38	1.42	1.43	1.49	1.52	1.53	1.59	1.53	1.55	1.48
LLC «Agro-Osvana» of the Kirovohrad region	1.49	1.46	1.50	1.53	1.53	1.60	1.63	1.64	1.64	1.68	1.57
LLC «Agrarian company «Zorya» of Kirovohrad region	2.77	2.53	2.55	2.53	2.58	2.64	2.67	2.67	2.68	2.70	2.63
ALLC «Agromaster» of Dnipropetrovsk region	3.17	3.12	3.16	3.06	3.06	3.07	3.03	3.01	2.98	2.99	3.07
LLC Agrofirma «Kolos» of Dnipropetrovsk region	2.36	2.44	2.40	2.39	2.41	2.46	2.45	2.41	2.43	2.44	2.42

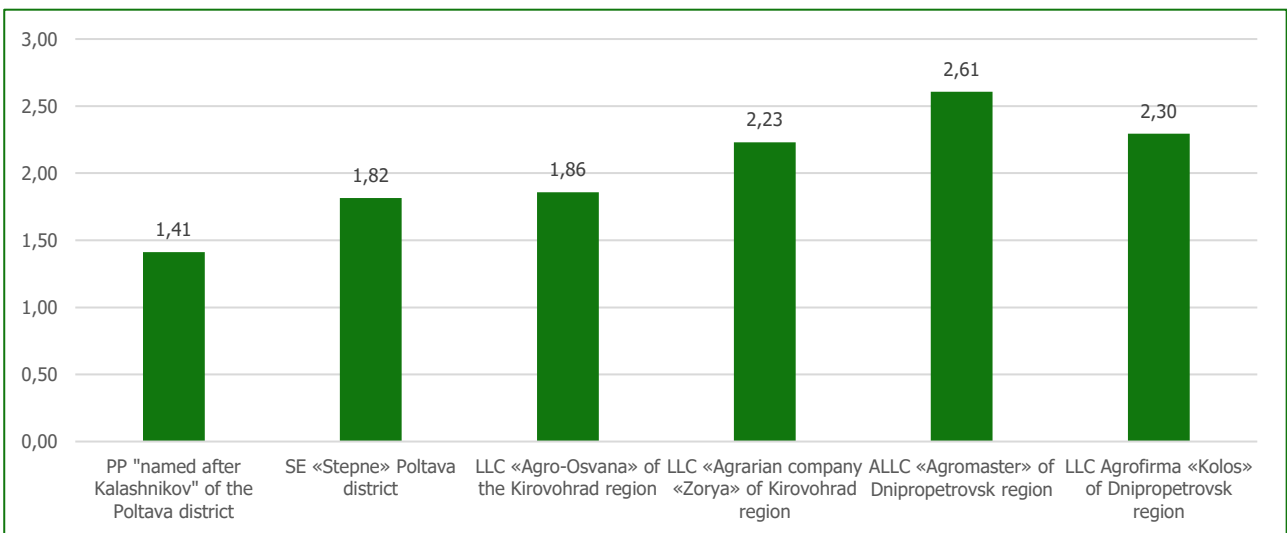


Figure 1. Dynamics of the complex indicator of financial security of six domestic innovative agricultural enterprises, 2014-2023.

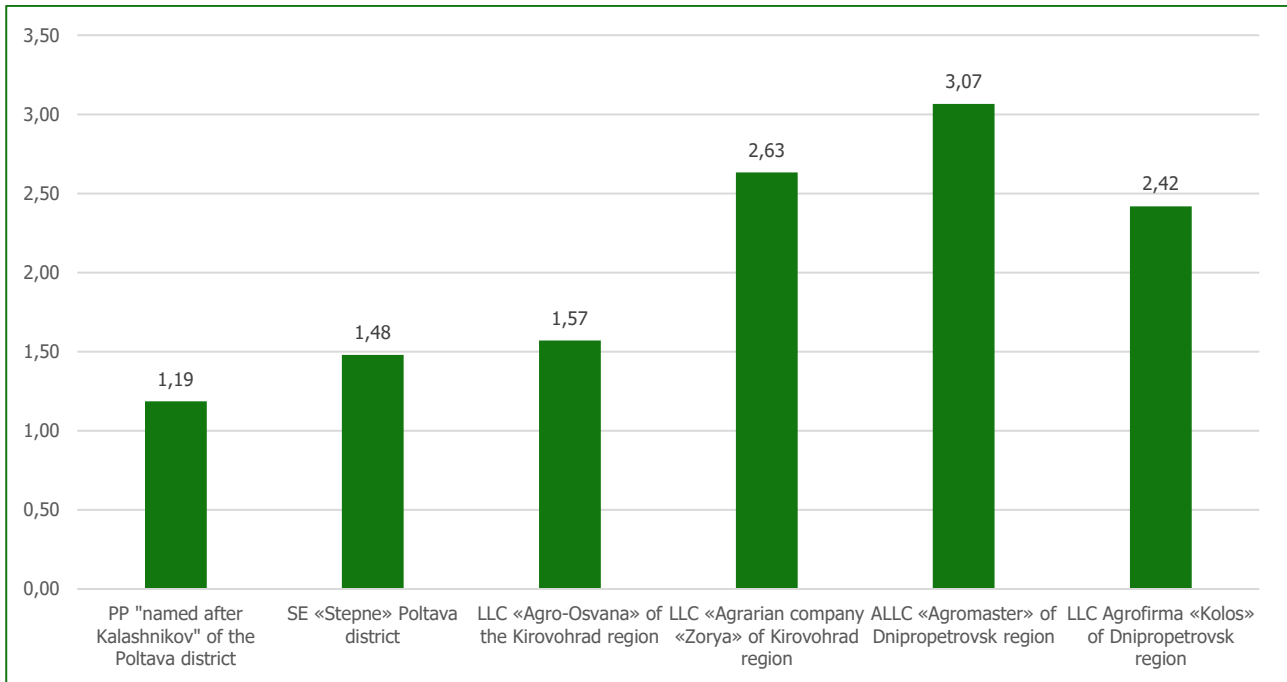


Figure 2. Dynamics of the complex indicator of security of personnel support of six domestic innovative agricultural enterprises, 2014-2023.

Using the above data and non-linear economic-mathematical models, we implement modelling of organizational and managerial security of financial and personnel support of innovative agro-entrepreneurship.

RESULTS

In order to model the evaluation of the effectiveness of organizational and managerial security and the interaction of financial security and the security of personnel support of innovative agribusiness, using statistical and financial data of the investigated economic entities of the agrarian sector, we conduct research, analysis, modelling and forecasting of the interaction of these indicators using economic and mathematical methods and models. In our study of the impact of the complex indicator of personnel security on the complex indicator of financial security of six innovative agricultural enterprises of the central region, we use nonlinear economic and mathematical models, in particular parabolic, hyperbolic and semi-logarithmic models. Let's move on to the practical implementation of the study of modelling the assessment of the interaction of the complex indicator of personnel security and the complex indicator of financial security of six innovative agrarian enterprises of the central region over the last decade. We reduce the main researched factors to a mathematical form and further calculation, marking: a complex indicator of personnel security, X is a factor sign; a complex indicator of financial security, Y is a performance indicator.

Further calculations are carried out with the help of Microsoft Excel spreadsheets, the statistical data analysis package "Statistica", built-in statistical, mathematical functions, arrays, and using nonlinear dependencies of second-order parabolic, hyperbolic and semi-logarithmic functions, the characteristics and description of which were presented above. According to the methodology, we perform linearization of non-linear production functions. As a result of data processing, the main parameters of the equations, coefficients of determination and elasticity were obtained to characterize the interdependence of the factor characteristic and the effective indicator (Table 4).

Table 4. Data processing results of the dependence of the comprehensive indicator of financial security on the comprehensive security indicator of personnel support of six innovative agrarian enterprises of the central region, 2014-2023.

Manufacturing nonlinear regression	Parameters of production nonlinear regression			Coefficient of determination	Coefficient of elasticity
	a ₀	a ₁	a ₂		
PP "named after Kalashnikov" of the Poltava district					
Parabolic nonlinear regression of the second order of the impact of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -28.58 + 53.47X - 23.68X^2$	28.58	53.47	23.68	0.71	53.56 -30.75
Hyperbolic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 1.84 - 0.50/X$	1.84	0.50	-	0.05	-0.26
Semi-logarithmic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 1.35 + 0.85 \log X$	1.35	0.85	-	0.03	0.07
SE «Stepne» Poltava district					
Parabolic nonlinear regression of the second order of the impact of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 1.48 - 3.07X + 2.22X^2$	1.48	-3.07	2.22	0.89	-2.12 2.50
Hyperbolic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 6.82 - 7.38/X$	6.82	-7.38	-	0.88	-1.95
Semi-logarithmic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -0.16 + 11.64 \log X$	0.16	11.64	-	0.88	1.07
LLC «Agro-Osvana» of the Kirovohrad region					
Parabolic nonlinear regression of the second order of the impact of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 36.20 - 42.27X + 12.96X^2$	36.20	42.27	12.96	0.52	-41.54 21.90
Hyperbolic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -0.63 + 3.89/X$	0.63	3.89	-	0.45	1.27
Semi-logarithmic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -2.97 - 5.68 \log X$	-2.97	-5.68	-	0.44	-0.76
LLC «Agrarian company «Zorya» of Kirovohrad region					
Parabolic nonlinear regression of the second order of the impact of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -38.02 + 30.34X - 5.71X^2$	38.02	30.34	5.71	0.38	35.53 -17.99
Hyperbolic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 2.93 - 1.84/X$	2.93	-1.84	-	0.26	-0.29
Semi-logarithmic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 1.57 + 1.58 \log X$	1.57	1.58	-	0.25	0.28
ALLC «Agromaster» of Dnipropetrovsk region					
Parabolic nonlinear regression of the second order of the impact of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 7.18 - 1.98X + 0.16X^2$	7.18	-1.98	0.16	0.59	-2.12 0.50
Hyperbolic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -0.48 + 9.46/X$	0.48	9.46	-	0.59	1.18
Semi-logarithmic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 6.05 - 7.09 \log X$	6.05	-7.09	-	0.59	-1.21
LLC Agrofirma «Kolos» of Dnipropetrovsk region					
Parabolic nonlinear regression of the second order of the impact of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -170.48 + 142.26X - 29.28X^2$	170.48	142.26	29.28	0.97	141.64 -71.62
Hyperbolic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = 4.91 - 6.32/X$	4.91	-6.32	-	0.14	-1.05
Semi-logarithmic nonlinear regression of the influence of the complex indicator of personnel security on the complex indicator of financial security					
$\hat{Y}_i = -0.01 + 6.01 \log X$	-0.01	6.01	-	0.14	0.95

So, the obtained result makes it possible to testify about the different levels of dependence of the complex indicator of financial security on the complex indicator of personnel security of six innovative agrarian enterprises. To compare the dependence of the complex indicator of financial security on the complex indicator of personnel security of six innovative agricultural enterprises, the correlation coefficient was determined (Table 5).

Table 5. Pearson coefficient of the studied enterprises.

Name of companies	Indicator	Connection and dependence
PP "named after Kalashnikov" of the Poltava district	0.75	the connection is a close, direct dependence
SE «Stepne» Poltava district	0.94	the connection is a close, direct dependence
LLC «Agro-Osvana» of the Kirovohrad region	-0.66	average relationship, inverse relationship
LLC «Agrarian company «Zorya» of Kirovohrad region	0.67	the relationship is average, direct dependence
ALLC «Agromaster» of Dnipropetrovsk region	-0.77	the connection is close, inverse dependence
LLC Agrofirma «Kolos» of Dnipropetrovsk region	0.87	the connection is close, direct dependence

Next, we forecast the factor characteristics and performance indicators of six innovative agricultural enterprises of the central region for 2025. For the factor characteristic of the complex indicator of personnel security, the built-in statistical function "TREND" is traditionally used, which accurately calculates the factor characteristics in dynamics (Table 6).

Table 6. Modelling of a factor characteristic in dynamics.

Name of companies	Indicator	Dynamics
PP "named after Kalashnikov" of the Poltava district	1.31	growth on 0,04 %
SE «Stepne» Poltava district	1.64	growth on 0,09 %
LLC «Agro-Osvana» of the Kirovohrad region	1.73	growth on 0,05 %
LLC «Agrarian company «Zorya» of Kirovohrad region	2.69	decrease on 0,01 в.п.
ALLC «Agromaster» of Dnipropetrovsk region	2.93	decrease on 0,06 в.п.
LLC Agrofirma «Kolos» of Dnipropetrovsk region	2.46	growth on 0,02 %

We observe a different predictive value of the complex indicator of personnel security, we understand that such a phenomenon is possible due to the influence of other dependent and independent factors, but the forecasting and modelling of the factor characteristic and performance indicator is based exclusively on the parameters of production models and coefficients. To calculate the performance indicator, we use the calculated non-linear production regressions: second-order parabolic, hyperbolic and semi-logarithmic, parameters of their equations. We group them, compare them and choose the best non-linear production regression, which can be implemented in real conditions of agro-business activity (Table 7).

Table 7. Comparison of the forecast value of the complex indicator of financial security of six innovative agricultural enterprises using three non-linear functions, 2025.

Production function	Forecast value of the comprehensive indicator of financial security, 2025	Characteristic	Absolute deviation of 2025 from 2023, +, -	The relative deviation of 2025 from 2023, %
PP "named after Kalashnikov" of the Poltava district				
Parabolic nonlinear regression $\hat{Y}_i = -28,58 + 53,47X - 23,68X^2$	1.31	Mediocre prediction result	0.19	116.68%
Hyperbolic nonlinear regression $\hat{Y}_i = 1,84 - 0,50/X$	1.46	The best prediction result	0.33	129.58%
Semi-log nonlinear regression $\hat{Y}_i = 1,35 + 0,85\log X$	1.45	Good prediction result	0.33	129.18%
SE «Stepne» Poltava district				
Parabolic nonlinear regression $\hat{Y}_i = 1,48 - 3,07X + 2,22X^2$	2.37	The best prediction result	0.12	105.17%
Hyperbolic nonlinear regression $\hat{Y}_i = 6,82 - 7,38/X$	2.32	Mediocre prediction result	0.07	102.91%
Semi-log nonlinear regression $\hat{Y}_i = -0,16 + 11,64\log X$	2.34	Good prediction result	0.09	104.04%
LLC «Agro-Osvana» of the Kirovohrad region				
Parabolic nonlinear regression $\hat{Y}_i = 36,20 - 42,27X + 12,96X^2$	1.76	Mediocre prediction result	0.06	103.27%
Hyperbolic nonlinear regression $\hat{Y}_i = -0,63 + 3,89/X$	1.77	Good prediction result	0.07	103.95%
Semi-log nonlinear regression $\hat{Y}_i = -2,97 - 5,68\log X$	1.79	The best prediction result	0.08	104.68%
LLC «Agrarian company «Zorya» of Kirovohrad region				
Parabolic nonlinear regression $\hat{Y}_i = -38,02 + 30,34X - 5,71X^2$	2.30	Mediocre prediction result	0.02	101.00%
Hyperbolic nonlinear regression $\hat{Y}_i = 2,93 - 1,84/X$	2.40	Good prediction result	0.12	105.33%
Semi-log nonlinear regression $\hat{Y}_i = 1,57 + 1,58\log X$	2.42	The best prediction result	0.14	106.19%
ALLC «Agromaster» of Dnipropetrovsk region				
Parabolic nonlinear regression $\hat{Y}_i = 7,18 - 1,98X + 0,16X^2$	2.743	Mediocre prediction result	0.02	100.69%
Hyperbolic nonlinear regression $\hat{Y}_i = -0,48 + 9,46/X$	2.748	The best prediction result	0.02	100.89%
Semi-log nonlinear regression $\hat{Y}_i = 6,05 - 7,09\log X$	2.745	Good prediction result	0.02	100.79%
LLC Agrofirma «Kolos» of Dnipropetrovsk region				
Parabolic nonlinear regression $\hat{Y}_i = -170,48 + 142,26X - 29,28X^2$	2.468	The best prediction result	0.07	103.10%
Hyperbolic nonlinear regression $\hat{Y}_i = 4,91 - 6,32/X$	2.457	Mediocre prediction result	0.06	102.63%
Semi-log nonlinear regression $\hat{Y}_i = -0,01 + 6,01\log X$	2.467	Good prediction result	0.07	103.05%

Analyzing the forecast values of the complex indicator of financial security of six innovative agricultural enterprises, we observe their growth. Therefore, for the further study and modelling of organizational and managerial security, taking into account the components of financial and personnel security, a wider range of financial ratios and personnel management ratios should be used, paying attention to their dynamic movement, especially the staff turnover ratio, which should decrease in the future dynamics. A graphical comparison of the forecast value of the complex indicator of financial security of six innovative agricultural enterprises using three non-linear functions, in 2025 is presented in Figures 3-8.

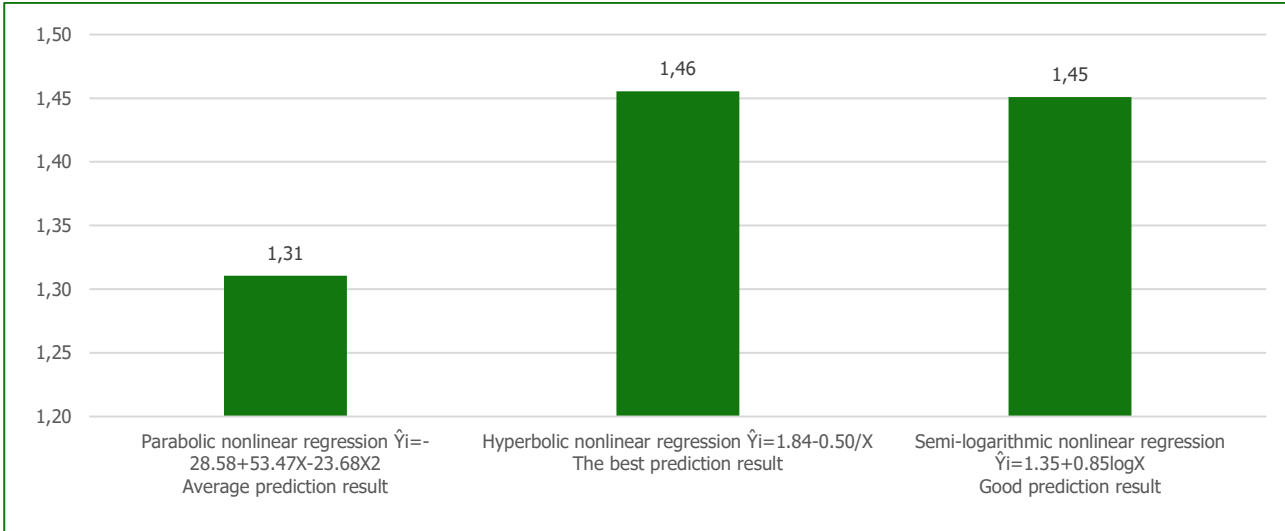


Figure 3. Comparison of the forecast value of the complex indicator of financial security of PP "named after Kalashnikov" of the Poltava district using three non-linear functions, 2025.

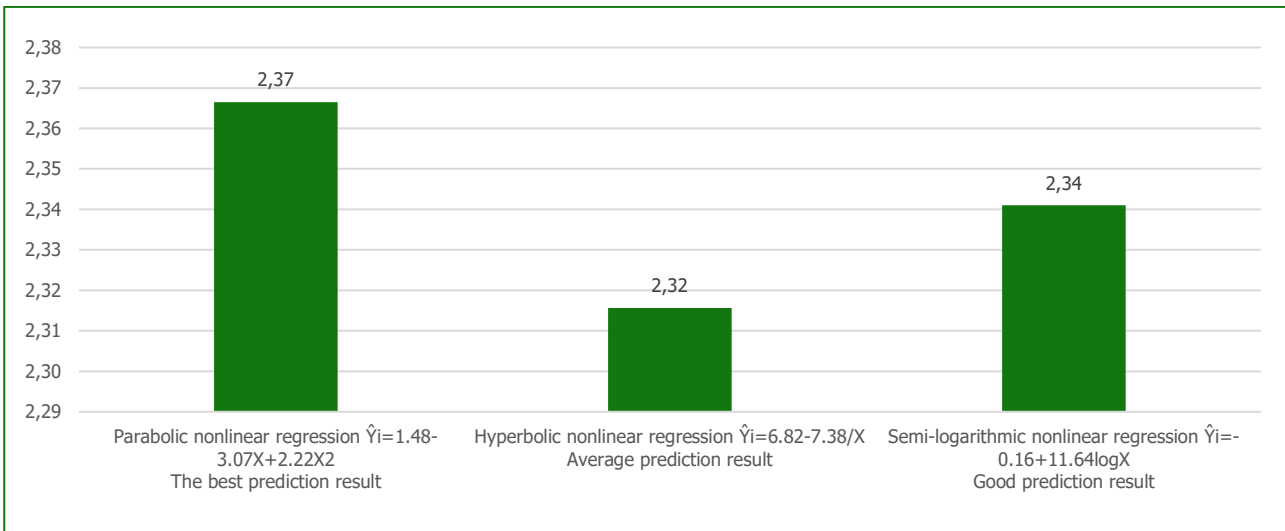


Figure 4. Comparison of the predictive value of the complex indicator of financial security of SE "Stepne" Poltava district using three non-linear functions, 2025.

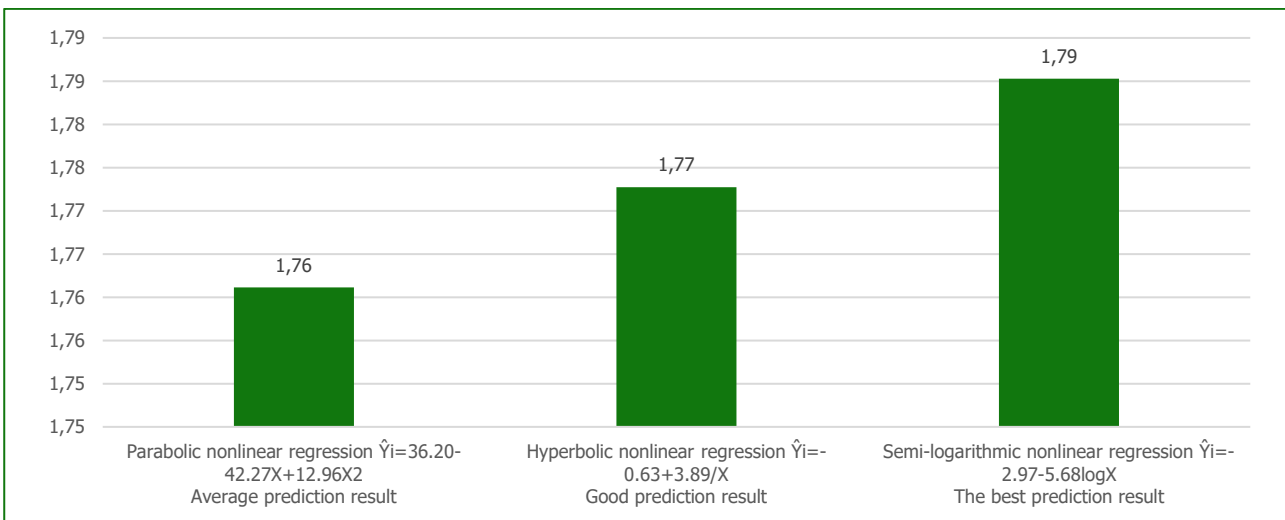


Figure 5. Comparison of the forecast value of the complex indicator of financial security of LLC "Agro-Osvana" of the Kirovohrad region using three non-linear functions, 2025.

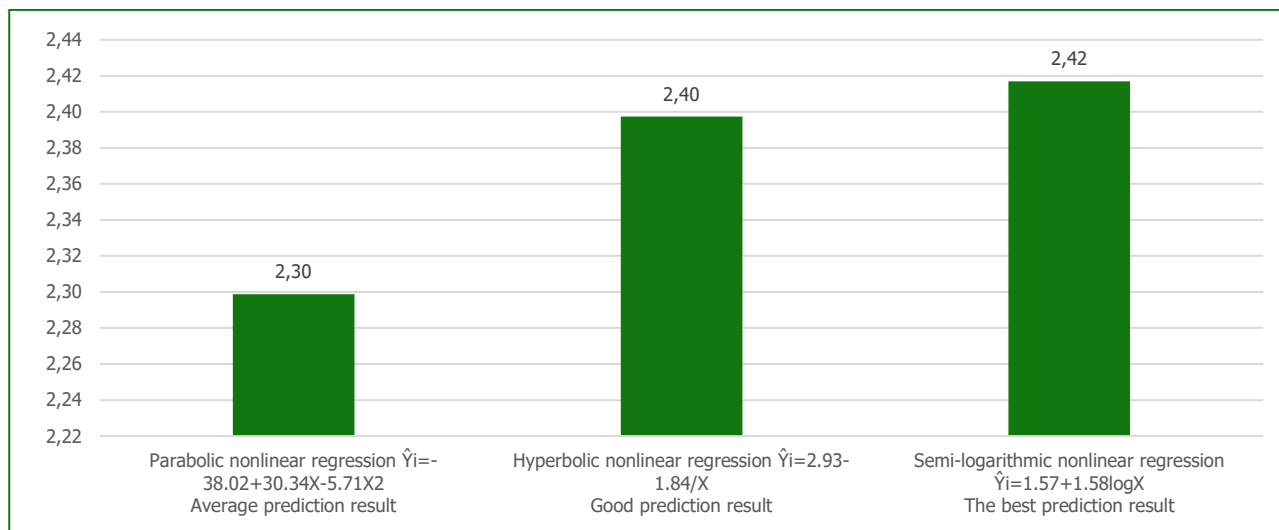


Figure 6. Comparison of the forecast value of the complex indicator of financial security of LLC "Agrarian company "Zorya" of Kirovohrad region using three non-linear functions, 2025.

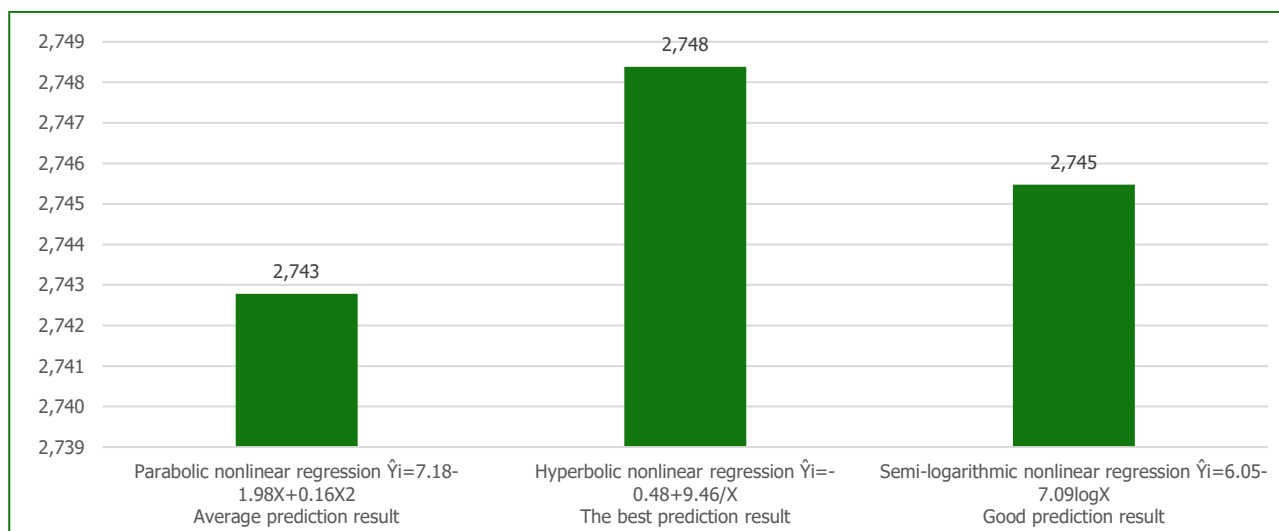


Figure 7. Comparison of the forecast value of the complex indicator of financial security of LLC "Agromaster" of Dnipropetrovsk region using three non-linear functions, 2025.

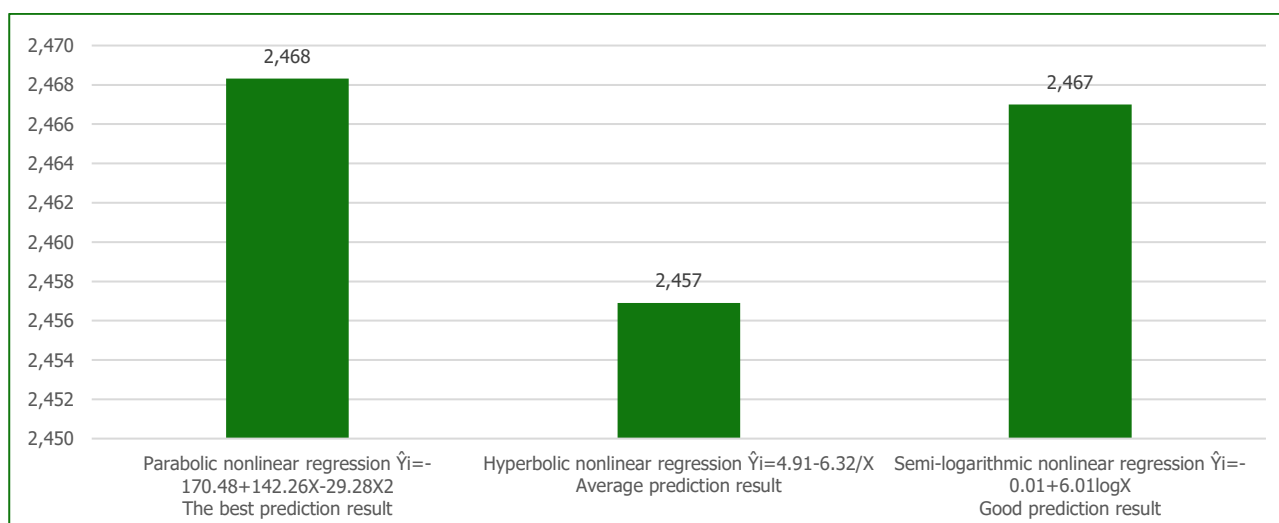


Figure 8. Comparison of the forecast value of the complex indicator of financial security of LLC Agrofirma "Kolos" of Dnipropetrovsk region using three non-linear functions, 2025.

So, the researched topic of modelling organizational and managerial security of financial and personnel support of innovative agribusiness, in particular, its main components of financial security and security of personnel management in the economic-mathematical interpretation of the dependence of the complex indicator of financial security on the complex indicator of personnel security is relevant, complex and multi-level.

DISCUSSION

Disadvantages include provisions (Kelly et al., 2003), yes, there are often infrastructure and logistics problems that make it difficult to supply inputs and technologies to farmers. In addition, political instability and weak institutions can hinder sustainable market development and attracting investment. Unequal access to finance, knowledge and technology between large and small farmers is also a barrier to even progress. The article (Zolkover and Ovcharenko, 2024) really defines the main aspects of security. However, the complexity of integrating various indicators and factors can lead to inaccuracies in the results. Also, the lack of a single methodology for evaluating innovative security makes it difficult to compare between different sectors or the high dynamism of technologies and market conditions makes such models quickly obsolete.

The controversial study (Zhyvko et al., 2022). In particular, persistent cyber threats and vulnerabilities can lead to data leakage or financial loss. The lack of proper digital infrastructure and safeguards exacerbates these risks. Also, the complexity of regulating digital processes in a globalized environment can create legal and ethical issues related to privacy and liability.

Certain questions raise research questions. External factors such as economic crises or changes in legislation can make forecasting less reliable. The disadvantages include the position of the authors (Vermeulen et al., 2012). Yes, it is difficult to coordinate actions and research at the global level due to the different political and economic interests of countries. Limited resources and access to technology among poor farmers make it difficult to implement innovations. Furthermore, a lack of funding and institutional support constrains the effectiveness of global partnerships and interventions. The provisions are debatable (Abuselidze et al., 2022). The topic of using hedge technologies to minimize price risks by agricultural producers has disadvantages related to the difficulty of implementing these technologies for small and medium-sized farmers due to limited financial resources, knowledge and access to markets, which can lead to insufficient protection against price fluctuations, especially in volatile markets. Scientists (Boughton et al., 2021) propose principles for minimizing the impact of a pandemic on the agrosector, but the pandemic has now ended, and therefore the principles and methods proposed by the authors are no longer relevant.

Therefore, the existing provisions and gaps in science testify to the correctness of our choice of topics for improvement and thorough analysis. Modelling the organizational and managerial security of financial and personnel support of innovative agribusiness is an important area of research due to the complexity of integrating innovations into agriculture, which requires a systematic approach to managing resources, personnel, and finances to ensure the sustainability and efficiency of agribusiness.

CONCLUSIONS

Thus, we proposed and practically tested the process of modelling the organizational and managerial security of financial and personnel support of innovative agro-entrepreneurship. All the tasks of our research have been fulfilled. In particular, we have defined and adapted mathematical models for assessing the impact and interrelationship of personnel support on the financial stability of agricultural enterprises and vice versa. Guidelines for forecasting the organizational and managerial security of financial and personnel support of innovative agribusiness, etc. have been determined. The analysis of the results of modelling the organizational and managerial security of innovative agricultural enterprises shows that there are different levels of relationship between the indicators of financial security and personnel security, which depend on the types of regression models used. The greatest impact of staffing on financial security is observed in parabolic models of the second order. This shows a strong relationship between indicators, especially for enterprises such as SE "Stepne" Poltava district (coefficient of determination 0.89) and LLC Agrofirma «Kolos» of Dnipropetrovsk region (coefficient of determination 0.97). Such models confirm that personnel security factors can significantly affect the financial stability of enterprises, were changes in personnel support lead to significant fluctuations in financial security.

For some enterprises, such as PP "named after Kalashnikov" of the Poltava district, hyperbolic and semi-logarithmic regressions show a weak or insignificant relationship between personnel factors and financial security (determination coefficients of about 0.05 and 0.03). This indicates that for such enterprises the impact of staffing on financial indicators is not the main factor, and other factors may be more important for their financial stability. Enterprises such as LLC «Agro-

Osvana» of the Kirovohrad region and LLC «Agrarian company «Zorya» of the Kirovohrad region showed an average level of interrelationship between the studied indicators. This means that personnel security affects financial stability, but this effect is not decisive and may depend on additional conditions. Thus, the overall modelling analysis indicates that the relationship between personnel and financial security varies by enterprise. In some cases, staff security is a key factor in financial stability, while in others its impact is limited. Therefore, the proposed methods of modelling and forecasting the financial and personnel support of innovative agribusiness are quite acceptable for modelling the organizational and managerial security of innovative enterprises.

Prospects for further research in the field of modelling the organizational and managerial security of financial and personnel support of innovative agro-entrepreneurship open up a wide space for the development of scientific approaches and practical solutions. One of the key directions is a detailed study of the specifics of agribusiness as a special industry that requires the integration of innovations into traditional production processes. This will allow the creation of models that take into account the unique risks of this industry, including natural and economic factors, the impact of climate change, seasonality and other aspects that distinguish agribusiness from other sectors of the economy. In the context of ensuring organizational and managerial security, it is necessary to conduct research aimed at developing adaptive management systems capable of quickly responding to changes in the external environment, as well as increasing the effectiveness of management decisions through automation and the use of modern digital technologies. Financing innovative agribusiness is another promising area of research, as this industry faces limited access to capital due to high risks. The development of models that will allow for a more accurate assessment of the risks and opportunities of attracting investments in the agricultural sector can contribute to increasing the attractiveness of innovative projects for investors. Personnel provision of innovative agribusiness also needs a deeper study in the context of organizational and managerial security. The modelling of personnel policy should be aimed at increasing the professional level of employees, creating favourable conditions for the introduction of innovations, and forming institutional mechanisms for personnel support. In addition, it is worth paying attention to the problem of attracting and retaining highly qualified personnel in agriculture, in particular in remote or economically less developed regions.

Thus, further research in this field is of great importance for improving the effectiveness of organizational and managerial security of innovative agricultural enterprises, as they will allow to ensure more accurate and timely management decisions, minimize risks and increase the competitiveness of enterprises in the global market.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

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The Authors declare that there is no conflict of interest.

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МОДЕЛЮВАННЯ ОРГАНІЗАЦІЙНО-УПРАВЛІНСЬКОЇ БЕЗПЕКИ ФІНАНСОВОГО ТА КАДРОВОГО ЗАБЕЗПЕЧЕННЯ ІННОВАЦІЙНОГО АГРОПІДПРИЄМНИЦТВА

Тема статті спрямована на дослідження впливу організаційних і управлінських рішень на стабільність агропідприємств в умовах інноваційної діяльності. Стаття акцентує увагу на взаємозв'язку між кадровою безпекою й фінансовою стабільністю, використовуючи математичні моделі для оцінки ризиків і оптимізації управлінських процесів. У

статті визначено необхідність моделювання організаційно-управлінської безпеки фінансового та кадрового забезпечення інноваційного агропідприємництва. Запропоновано для такого моделювання застосовувати нелінійні економіко-математичні моделі, які дають змогу глибше розуміти взаємозв'язки між різними чинниками, що впливають на діяльність підприємств. Визначено, що такі моделі дозволяють краще зрозуміти, як зміни в одному секторі впливають на інші, і дають можливість розробляти стратегії, що зменшують ризики та підвищують стійкість підприємства. Запропонована нами методика моделювання організаційно-управлінської безпеки фінансового та кадрового забезпечення інноваційного агропідприємництва адаптована на прикладі ПП «ім. Калашника» Полтавського району; SE «Stepne» Poltava district; LLC «Agro-Osvana» of the Kirovohrad region; LLC «Agrarian company «Zorya» of Kirovohrad region; ALLC «Agromaster» of Dnipropetrovsk region; LLC Agrofirma «Kolos» of Dnipropetrovsk region. У результаті моделювання прогнозування організаційно-управлінської безпеки фінансового та кадрового забезпечення інноваційного агропідприємництва було визначено, що взаємозв'язок між кадровою та фінансовою безпекою варіюється залежно від підприємства. У деяких випадках кадрова безпека є ключовим фактором для фінансової стабільності, водночас в інших її вплив обмежений. Запропонована методика моделювання буде корисна в системі планування менеджменту й фінансової політики для вітчизняних агропідприємств, які прагнуть інноваційного розвитку й турбуються про забезпечення ефективної фінансової та кадрової безпеки.

Ключові слова: безпека, фінансове забезпечення, кадрове забезпечення, інноваційне агропідприємництво, фінансовий стан підприємств, управління персоналом, плинність кадрів

JEL Класифікація: Q14, O15, O31