INVESTMENT EXPENDITURES IN UKRAINIAN AGRICULTURAL ENTERPRISES: PROGNOSIS AND DEVELOPMENT OF APPROPRIATE INVESTMENT STRATEGY

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A b s t r a c t. Increasing the level of innovation and investment support for agricultural enterprises is particularly relevant. This enables them to function effectively in a dynamic, open environment. Thus, the main purpose of the paper is to characterize the current state and sources of investment expenditures in agricultural enterprises in Ukraine, and to make predictions on the inflow of investments in the agricultural sector in the future. Basing of this prognosis the recommendation of the appropriate steps towards investment strategy development in farming firms was formulated. ARIMA forecasting method was used in the article to determine the future expenditures for investments in Ukrainian agricultural sector. It was observed that there has been an inflow of investments in the area of Ukrainian agriculture in recent years. Additionally it was forecasted that this growth will continue in the future. Different scenarios tested showed an increase from 11 to 30% in 2019. Additionally companies could attract and utilize the FDI funds, which unfortunately decreased during the period 2015-2017 in agricultural sector. It could be however expected that this trend will revert together with changing political and economic situation of Ukraine, and companies could use these resources for their development.

INTRODUCTION

Nowadays, an essential condition for the effective development of agricultural enterprises is incensement of innovation and investments, which will promote sustainable development of the agricultural sector in the conditions of globalization of the world

economy. The combination of innovation and investment activities is an important pre-requisite for the effective functioning of agricultural firms that ensures competitiveness of the agricultural sector, both on the domestic and foreign markets. Unfortunately, there are certain reasons that hinder the development of innovations and investment activities in agricultural production. The overwhelming majority of agricultural enterprises in Ukraine is characterized by technological backwardness with a high level of deterioration of fixed assets, insufficient number of skilled workers and financial resources, which prevents innovative developments in agricultural production [Kharchenko, Kharchenko 2015a]. Therefore, nowadays the question of investment dimensions in agricultural enterprises requires development of a systematic approach that will facilitate their efficient management.

Many authors made significant contribution to the study of investment developments of agrarian business [i.e. Banaszewska 2018, Heets, Semynozhenko 2006, Grudzynsky et al. 2010, Ermakov, Kharchenko 2014, Ilychuk, Shpomer 2017, Latruffe 2010]. At the same time, despite the presence of a considerable number of scientific works devoted to issues of innovation and investment development of agricultural production, it should be noted that there are still a number of unresolved issues regarding the features and directions of innovations and investment development in agricultural enterprises in current economic conditions.

Thus, the main purpose of the paper is to characterize the current state and sources of investment expenditures in agricultural enterprises in Ukraine, and to make predictions on the inflow of investments in the agricultural sector in the future. Basing of this prognosis the recommendation of the appropriate steps towards investment strategy development in farming firms will be formulated.

MATERIALS AND METHODS

State Statistics Service of Ukraine (SSSU) and Ministry of Agrarian Policy and Food of Ukraine (MAPFU) data have been used in the analysis. Data coming from the SSSU referred to the capital investments into Ukrainian agriculture and foreign investments in the economy of Ukraine. Data concerning labour productivity and level of profitability of agricultural activity have been accessed from MAPFU. Data for 2001-2016 have been collected.

Methodological basis of the study is mathematical mechanism of system analysis, economic-mathematical modelling and multidimensional statistical analysis. In order to study the dynamics of capital investments in the agricultural economy of Ukraine the model of the Auto Regressive Integrated Moving Average (ARIMA) was used to predict the capital investments coming into the domestic agricultural sector.

This technique does not foresee any structure of the time series data, but only applies an iterative approach to determine the admissible model from the aggregate of the models under study. Next, it is needed to compare the selected model with the data sources and to verify the correctness of the time series description. The model under investigation was considered adequate if the residuals were small enough and didn't contain useful information. Otherwise, with not appropriately chosen model, it was necessary to repeat the selection process, but with the use of the new model.

This procedure should have been carried out until an adequate model was found. After that, the selected model could be used for forecasting. Hence, we obtained the autoregressive model and the moving average order (p, q) - ARIMA (p, q), which contains p + q + 1 parameters (forms 1).

$$v_n = \alpha_n + \sum_{i=1}^{p} \varphi_i v_{n-1} - \sum_{i=1}^{Q} \theta_i \alpha_{n-i} \tag{1}$$

In the case when the investigated series v (t) have signs of non-stationary (deterministic trends - linear, polynomial, etc.), such model cannot be adequate.

Under such conditions, some difference of the d study may be stationary: $\bar{\omega}_n = \nabla^d \vartheta_n$ where the first difference (analogous to the operation of differentiation), ∇^d means the successive application of d times of ∇ operator. The ϖ_n process itself can be described by using an effective ARMA model.

The next step was to estimate Auto Regressive Integrated Moving Average model (p, d, q) - ARIMA (forms 2 and forms 3):

$$\bar{\omega}_n = \alpha_n + \mu + \sum_{i=1}^{p} \varphi_i \bar{\omega}_{n-1} - \sum_{i=1}^{Q} \theta_i \alpha_{n-1} \tag{2}$$

$$\bar{\omega}_n = \nabla^d \vartheta_n \tag{3}$$

Thus, on the basis of the investments data we forecasted the capital investments in the agricultural sector based on the Boxing-Jenkinson method.

At the first stage of the study, we tested our line-up for stationary. For this purpose, using the analytical software package Minitab 16, the coefficients of autocorrelation and partial autocorrelation of the studied series were found. The next step was to test the series for stationary. Applying the Dickey-Fuller test on the studied series on the basis of the least squares method revealed its non-stationary nature. Therefore, for the transformation of this series, it was necessary to make the transition to the first difference of events and get a stationary series in which as a unit of observation acts (form 4)

$$\Delta Y_t = Y_t - Y_{t-1} \tag{4}$$

After analysing the coefficients of autocorrelation and partial autocorrelation and their graphs for forecasting, the Box-Jenkinson model of ARIMA (1.1.0) with a constant was adopted.

Subsequently, the model parameters were evaluated. Using formula 5, a residual mean square error was found that was used to compare and evaluate the various models studied. It can also be used to determine the marginal forecast error.

$$S^2 = \frac{\sum_{t=1}^{n} \left(Y_t - \hat{Y}_t \right)^2}{n - r} \tag{5}$$

where $Y_t - \hat{Y}_t$, the balance at a certain time t, n - total amount of residues, r - total number of evaluation parameters.

When testing the model under investigation for adequacy, it was necessary to analyse prediction errors. If they are fairly small and randomly distributed, then this model is considered acceptable or adequate.

A general test for the adequacy of the selected model was carried out by evaluating the residue autocorrelation, as well as the hi-square test (χ^2) based on the modified Box-Pierce Q-statistics. The analysis of the coefficients of the model testified to their significance. A "chi-squared" (χ^2) test was also carried out, according to which it was verified that the residual auto-correlation coefficients for the period 12 were within the permissible limits.

RESULTS AND DISCUSSION

Nowadays an important condition for ensuring the effective development of agricultural enterprises is strengthening their innovative and investment potential. It will promote the production of high-quality and competitive products, technical and technological rearmament of the industry, to increase the efficiency of management of innovations and investments in the agricultural sector and to ensure the country's food security. Ukrainian agricultural enterprises have potential for increasing agricultural production and for development of foreign trade, but it requires constant investments [Lupenko et al. 2014, Ermakov, Kharchenko 2014].

Investment activity is an important factor of accelerating the development of agriculture [Gudzynsky et al. 2010]. The main objective of innovations support in agriculture should be assuring economic viability of farms and environmental friendliness of agricultural production. But, unfortunately, in the agri-food sector, unlike the other areas, development of innovations and investment processes take the progressive and slowly angle, requiring special attention. Additionally, agricultural investments have a number of peculiarities in comparison with investments in other branches of the economy, namely a long process of development; in the most cases - replacement character, are dealing with living organisms, the leading role of research institutions, dependence on the natural conditions [Sabluk et al. 2010].

At the same time, many barriers and restraining factors arise on the way of investments development of agricultural enterprises. These are internal (organizational issues, lack of staff qualifications, insecurity of information), external (imperfect relations with firms-competitors, low-quality products), economic (significant degree of risk, availability of financing), market (unbalanced supply and demand, underdevelopment of innovation infrastructure, low solvency of the customer) and problems of state regulation (negative influence of state regulation, insufficient activity of the state in the industry, non-regulation of legislation) [Kharchenko, Kharchenko 2015b].

A negative factor in shaping the resource potential of agricultural enterprises is that agriculture is a less attractive investment sector than other branches of the economy. This is due to a long period of agricultural production, which is often extended over a year and is characterized by a gradual increase in investments from the start of production to its completion and the simultaneous release of funds at the end of production in the production of finished products [Ilychuk, Shpomer 2017, Kharchenko, Kharchenko 2015a]. Potential investors direct their capital primarily to those industries where there is a rapid circulation of funds, and hence where it is possible to get a quick return on its investment.

It should be noted that in recent years there has been an inflow of investments in the field of Ukrainian agriculture as evidenced by data on the figure 1.
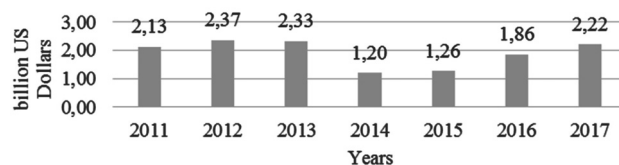
Figure 1. Dynamics of capital investments into Ukrainian agriculture in billion US Dollars

Source: authors' calculations based on data from SSSU for years 2011-2017.

Table 1. Direct foreign investments in the economy of Ukraine during the period 2005-2017

Indicators	Direct foreign investments in the economy in year [millions of dollars]						Change 2010-2017 [%]
	2010	2012	2014	2015	2016	2017	
Total FDI in Ukraine	39824,5	49494,4	53704	40725,4	36154,5	37655,5	76,1
FDI in Agriculture	680	736	776,9	617	502,2	500,1	67,9
The share of agriculture in total FDI, [%]	7,5	8,1	8,6	6,8	5,6	5,5	x
Food production and processing, drinks and tobacco products	1924,3	2221,9	3228	2706,4	2419	2550,9	114,8
The share of the food industry, %	21,3	24,6	35,7	29,9	26,7	28,2	x

Source: authors' calculations based on data from SSSU for years 2011-2017.

Usually own resources, derived from regular economic activity, are the main resource of financing the investments in fixed assets in agricultural enterprises of Ukraine. However, with each passing year, the volume of direct foreign investment adds to this resource the foreign capital (table 1).

It is interesting that despite growing FDI expenditures until 2015, the opposite trend occurred afterwards. This could be explained by the political and economic situation in the country, high risks and uncertainty of the market environment, non-compliance of domestic agricultural commodity producers with contractual obligations, imperfect legislative framework, lack of an all-Ukrainian base of foreign investors, and other factors influencing the formation of the investment climate. In addition, the most of agricultural producers cannot independently create investment projects for attracting foreign investors and presenting the benefits of their projects, due to the lack of personnel of the appropriate level and qualification and funds. Unfortunately, small and medium-size farms are not able to compete with large agro-holdings of Ukraine in the struggle for foreign investors, who in most cases prefer a profitable and reliable business as large enterprises.

The analysis of the dynamics of the efficiency of investment support for agriculture in Ukraine has shown an increase in the overwhelming majority of indicators (table 2.). Therefore, in 2017, the profit level of agricultural enterprises has increased substantially, although the size of the sown area has not increased in recent years. There is also a tendency towards a reduction in the number of workers involved in the agricultural sector together with the simultaneously increasing labour productivity.

Table 2. Dynamics of the efficiency of investment support of agriculture enterprises in Ukraine in years 2013-2017

Indicators	Size in a year					Change 2013-2017 [%]
	2013	2014	2015	2016	2017	
Investment in fixed assets at current prices per 1 ha of agricultural land in agricultural enterprises, UAH	912	895	706	1196	1527	167,4
Fixed assets and current assets per 1 ha of agricultural land in agricultural enterprises, UAH	15106	15230	15985	16132	16274	107,7
Gross output per 1 ha of agricultural land in agricultural enterprises, UAH	6683	6767	7431	7717	8261	123,6
Profit from the sale of agricultural products and services	699	1863	1998	2309	2631	376,4
Labor productivity, UAH / person	201217	227753	223310	275318	271491	134,9
Level of profitability of agricultural activity, %	12,0	26,4	45,6	37,3	41,8	X

Source: authors' calculations based on data from SSSU and MAPFU for years 2011-2017.

Modern management in agricultural enterprises involves a special approach to innovations. With the aim of increasing efficiency, innovations open up the broad prospects for the development of modern agribusiness. Successful innovations and investment activity helps to create a positive image of the company, increase competitiveness leads to more efficient use of scarce resources, and increases profits. However, unfortunately, the possibility of using innovations by agricultural enterprises is rather limited due to the influence of many factors: the lack of financial resources; a sharp rise in prices for new means of production; the lack of regulatory mechanisms that promote the use of innovations in agriculture.

It should be noted that market processes and various transformations in Ukraine are quite dynamic nowadays, which requires constant planning, as well as forecasting. Application of modern methods of forecasting of innovations and investments in farms will allow to timely adopt the right managerial decisions regarding production activity. Consequently, in the market conditions, forecasting is one of the decisive factors in the formation of a strategy and tactics for the production and economic activity of agricultural enterprises. In order to develop an optimal innovation and investment strategy, which will promote the development of optimal measures for the development of appropriate activity, the forecast of capital investments in the agricultural sector has been implemented.

Figure 2. shows the results of forecasting of capital investments in agriculture in graphical form. This figure shows three options for forecasting investments. According to the realistic version in 2019 the growth of capital investment in agriculture by an average of 30% is forecasted. This growth of value of investments will allow efficient formation and provision of resource potential of agricultural enterprises, which in turn will contribute to the growth of the level of efficiency of production and economic activity.
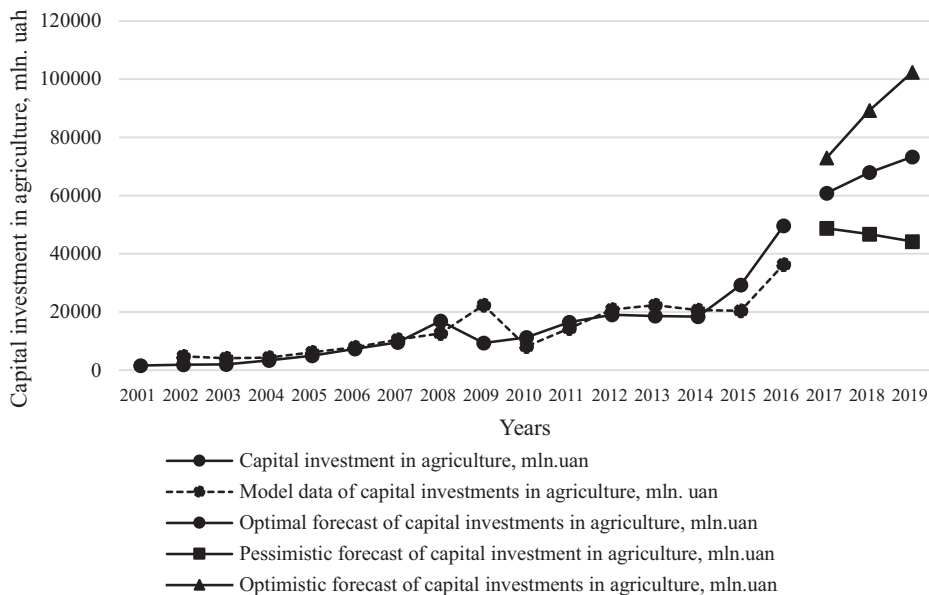
Figure 2. Forecasting capital investments in agriculture, forestry and fisheries in Ukrainian in years 2017-2019

Source: authors' calculations based on data from SSSU for years 2001-2016.

When testing the model under investigation for adequacy, it is necessary to analyze prediction errors. If they are fairly small and randomly distributed, then this model is considered adequate. Autocorrelation is a correlation of the output time series with itself only with a shifted period to a defined lag (L). To do this, T coefficients were calculated to verify the significance of the auto-correlation coefficient with delay k. This coefficient is calculated by the formula 6 [Kharchenko, Kharchenko 2015a].

$$t = \frac{r_k - p_k}{SE(r_k)} \tag{6}$$

The Luna-Boxing test for all seven time intervals gives low values of LBQ. This explains that the rows of residues are random and within [-0.6; 0.6]. Consequently, we can convincingly say that this method provides an adequate forecast of investments in agriculture. The autocorrelation function of the residues for the model under study is depicted in figure 3. The figure 3 shows that none of the coefficients of autocorrelation residues is substantially greater than zero.

Therefore, in order to check the absence of autocorrelation of the ARIMA residues, a graphical analysis of the residue correlates, Darbin-Watson and Lung-Box statistics were used which showed that the residues were not linearly corrected.

On the basis of the performed forecast it is necessary to propose a strategy of investment directions in agricultural enterprises, which will ensure the dynamic and efficient development, its economic stability and safety. Thus, enterprises should focus their efforts on the priority areas recalled in the literature [Kharchenko, Kharchenko 2015a, Gudzynsky et al. 2010]:
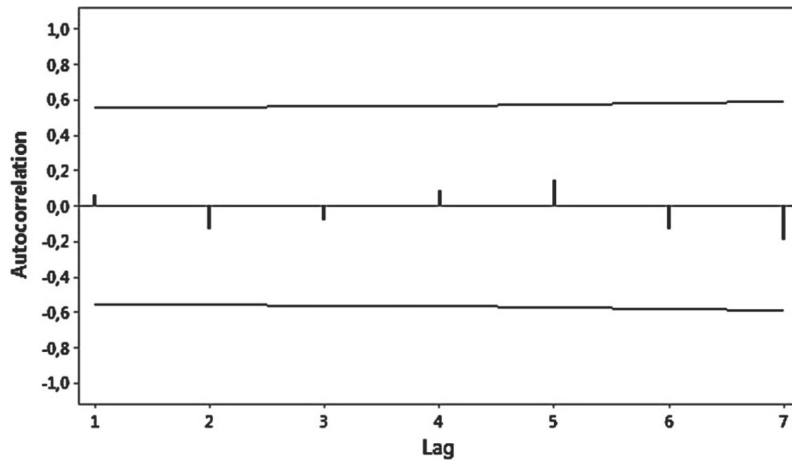
Figure 3. Autocorrelation function for the model
Source: authors' calculations.

1) an objective and reliable assessment of the innovative level of the enterprise - the definition of a system of indicators of its socio-economic development, the effectiveness of the development and implementation of the production, implementation of scientific and technical policy.
2) updating the technical and technological base, introduction of complex mechanization and automation of production and management;
3) strengthening the direction of the current system of labour motivation to maintain innovation and innovation climate in the enterprise;
4) forming a new staff structure, in particular, through the improvement of skills and creative activity of employees, as well as an innovative upgrade of all spheres of activity, directions of organization of production and labour, elements of management systems.

It should be noted that without the use of intellectual potential, which focuses primarily on its personnel, the agricultural sector cannot function dynamically and effectively. Unfortunately, the human resources problem in the rural areas is crucial in Ukraine and should be considered in the context of the overall labour resources' problem in the country.

In developing an investment strategy, it is necessary to take into account its certain features. One of the main conditions for the sustainability and viability of agricultural enterprises is continuous improvement of economic efficiency, technologies and search of innovative solutions. All this requires the development of sound management decisions.

In order to attract an external resources for investments, the attractiveness of Ukrainian agricultural sector for potential FDI companies has to be developed. Therefore, the development of an investment strategy of firms in order to obtain external capital support for investments is particularly important.

The development of an investment strategy for providing the resource potential of Ukrainian agricultural enterprises should be aimed at ensuring [Lupenko et al. 2014] the continuous investment activity in the foreseeable volumes; the most effective use of own and borrowed investment funds, the financial sustainability of a particular enterprise in

the long run. Based on scientific research and own observations, we believe that the investment strategy of a farm is a system of elements with an appropriate set of interconnections between them.

Figure 4. depicts the model of development of an investment strategy for agricultural enterprises.

The exchange of information resources provides a synergistic effect in developing and implementing an investment strategy, combining all aspects into one development path. Information exchange allows determining priorities, to coordinate the duration, stages and conditions of investments in accordance with the adopted strategy of the agricultural enterprise.

The institutional support for an investment strategy includes such elements as: types of investments, investment portfolio, risks. The legal and normative provision of an investment strategy consists of legislative and other regulatory acts, based on which agricultural enterprise forms an investment strategy and ensures its own investment attractiveness and accounting policy of the enterprise.

Economic support includes a set of economic components of an investment strategy such as a set of economic and financial indicators to assess the investment attractiveness of agricultural firm.

Under the organizational aspect, it is appropriate to understand all interdependent internal structural services and units of the agricultural enterprise, which ensure the deve-
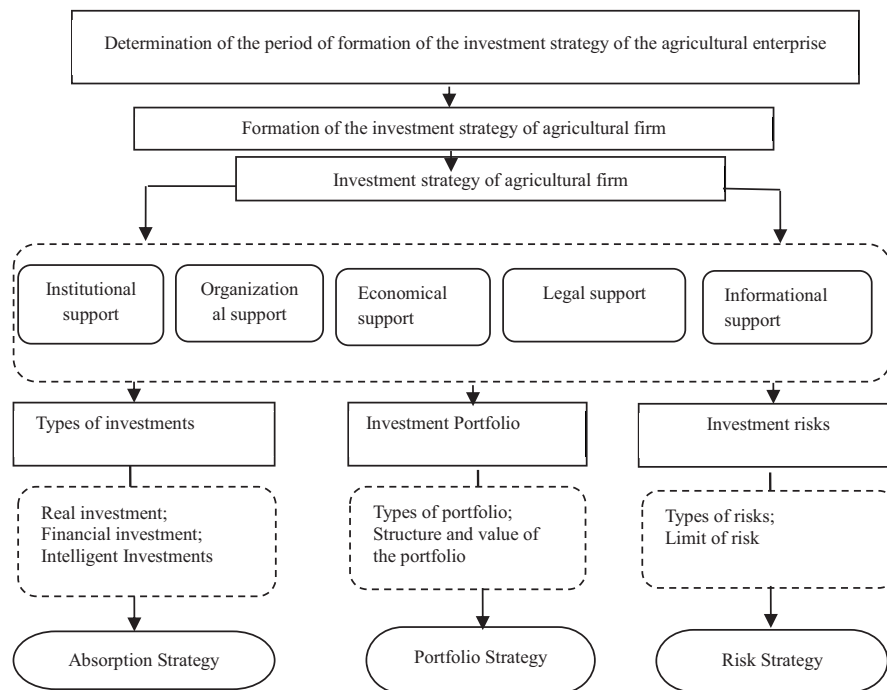

Figure 4. Model of development of innovation-investment strategy of agricultural enterprises

Source: authors development.

lopment and adoption of managerial decisions on investment activities and bear responsibility for the results of these decisions.

Note that in the process of development of innovation-investment strategy it is necessary to take into account such features: the strategies of agricultural enterprises can vary depending on the environment. They can themselves shape or respond to these changes by their active influence (adaptation strategy); the strategy of agrarian formation characterizes the general direction of its development, therefore there is a need to supply it with the measures of tactical order.

CONCLUSIONS

The study revealed that one of the main factors of effective activity of agricultural enterprises, which allows to assure their sustainable and viable future, is their investment activity. In this paper, ARIMA prediction algorithm has been applied, which has allowed adequately to determine the amount of investments in agriculture. It is shown that the most optimal model for forecasting investments in agriculture is ARIMA (1,1,0) with a constant.

It was observed that there has been an inflow of investments in the area of Ukrainian agriculture in recent years. Additionally it was forecasted that this growth will continue in the future. Different scenarios tested showed an increase from 11 to 30% in 2019. Additionally the companies could attract and utilize the FDI funds, which unfortunately decreased in last 3 years in agricultural sector. It could be however expected that this trend will revert together with changing political and economic situation of Ukraine, and companies could use this resources for their development.

In order to attract an external resources for investments, but also to plan investment activities from own resources the development of an appropriate investment strategy is particularly important. The steps and potential dimensions of this development process were proposed in the paper.

REFERENCES

Agricultural of Ukraine 2016: *Statistical yearbook, State Statistics Service of Ukraine*, Kyiv 2017. p. 246.

Banaszewska Monika 2018: *The determinants of local public investments in Poland*. Equilibrium. Quarterly Journal of Economics and Economic Policy,13 (1), 105–121.

Ermakov Oleksandr, Kharchenko Hanna 2014: *Agri-food potential of agricultural enterprises: formation and efficiency of use: monograph*. Kyiv. p. 218.

Gudzynsky Oleksii, Sudomir Svitlana, Gurenko Tamara 2010: *Management of the formation of competitive potential of enterprises (theoretical and methodological aspect)*, Kyiv, IPC SSSU. p. 212.

Heets Valerii, Semynozhenko Volodymyr 2006: *Innovative perspectives of Ukraine*. Constant, Kharkiv. p. 272.

Ilychuk Valerii, Shpomer Tetiana 2017: *Innovation and investment activity of agricultural sector: modern state and problems of development*. Retrieved: https://ageconsearch.umn.edu/record/256884 Access: 25.05.2018

Kharchenko Volodymyr, Kharchenko Hanna 2015a: *Innovative and investment support for the formation of the agricultural potential of agricultural enterprises: monograph*. Kyiv. p. 264.

Kharchenko Volodymyr, Kharchenko Hanna 2015b:. *Optimization of the use of productive resources of agrarian business*. Scientific Economic Journal "Actual Problems of Economics". no. 10 (172). Kyiv. pp. 458-465.

Latruffe Laure 2010: *Competitiveness, Productivity and Efficiency in the Agricultural and Agri-Food Sectors*, OECD Food, Agriculture and Fisheries Papers, No. 30, p. 62.

Lupenko Yuriy, Malik Mykola, Shpiculyak Oleksandr, etc. 2014: *Innovative support for the development of agriculture in Ukraine: problems and prospects*. Kyiv, p. 516.

Sabluk Petro, Shpykuliak Oleksandr, Kurylo Liudmyla, etc. 2010: *Innovative activity in the agricultural sector: institutional aspect*. NSC IAE, Kyiv. p. 706.

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WYDATKI INWESTYCYJNE PRZEDSIĘBIORSTW ROLNYCH NA UKRAINIE: PROGNOZA ORAZ PRZYGOTOWANIE ODPOWIEDNIEJ STRATEGII INWESTYCYJNEJ

Synopsis

Wzrost poziomu innowacyjności i wsparcia inwestycyjnego są szczególnie ważne dla przedsiębiorstw rolnych. Dzięki temu mogą one skutecznie funkcjonować w dynamicznie zmieniającym się otoczeniu. Głównym celem artykułu jest scharakteryzowanie obecnego stanu i źródeł nakładów inwestycyjnych w przedsiębiorstwach rolnych na Ukrainie oraz próba prognozy napływu inwestycji w sektorze rolnym w przyszłości. Na podstawie tej prognozy sformułowano rekomendację odpowiednich kroków w kierunku rozwoju strategii inwestowania w przedsiębiorstwach rolniczych. W artykule wykorzystano metodę prognozowania ARIMA do określenia przyszłych nakładów na inwestycje w ukraińskim sektorze rolnym. Zaobserwowano, że w ostatnich latach nastąpił znaczny napływ inwestycji do ukraińskiego rolnictwa. Dodatkowo prognozowano, że wzrost ten będzie kontynuowany w przyszłości. Testowane różne scenariusze wykazały wzrost z 11 do 30% w 2019 r. Dodatkowo przedsiębiorstwa mogły pozyskać fundusze zewnętrzne w postaci bezpośrednich inwestycji zagranicznych, które niestety zmniejszyły się w latach 2015-17 w sektorze rolnym. Można się jednak spodziewać, że tendencja ta odwróci się wraz ze zmieniającą się sytuacją polityczną i gospodarczą Ukrainy.

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