



## Financial Dominant of Activation of Investment Opportunities of Agro-food Production Entities of Ukraine

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### ABSTRACT

The article examines the financial toolkit for the distribution of resources of the public-private partnership institute, which changes the sources of the investment flow according to the balanced value of their target use in order to restore and ensure the activation of investment opportunities of agro-food production entities. It has been proven that the level of activation of sources of investment flow of agro-food production entities in a certain territory, provided that the public-private partnership institute is involved in this process, is normalized at a moderate risk and is attractive for investors. A comparison of the relative index of activation of the potential of investment opportunities of agro-food production subjects under the conditions of financial support of the public-private partnership institute in Ukraine and EU countries was made. The structure of the distribution of the sources of the investment flow of the public-private partnership institute. The nominal level of profitability of sources of investment flow from international partners in the distribution system of the institute of public-private partnership for the needs of realization of investment opportunities of producers of agro-food products has been calculated. The model of synergistic adaptation of the financial determinant in the own sources of the investment flow of agro-food production entities with the help of Euler circles is proposed. The estimated value of sources of investment flow for the renewal of agricultural machinery, mineral fertilizers of subjects of agro-food production of Ukraine with the support of the institute of public-private partnership was determined.

**Keywords:** Financial dominant, Investment opportunities, Investment capital, Investment flow, Financial support.

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### INTRODUCTION

The development of the national economy of Ukraine in the post-war period and the strengthening of the competitive positions of manufacturers in world markets are connected with the reduction of the level of energy and resource intensity of finished products and the increase of the potential of investment opportunities. However, in wartime conditions, it is impossible to compete with foreign manufacturers and conquer new markets with the country's modern investment potential, since the state does not have a reliable financial platform for joining forces with private partners who are able to help restore the hidden investment opportunities of subjects of the agro-food industry (Ostapenko et al., 2020). This causes a dynamic outflow of investment flows to other sectors of the country's economy. It should be noted that the agro-food sector in Ukraine is a structural link of the national economy of Ukraine and is adapted to the principles of targeted use of the investment and credit mechanism of economic entities

(Bazaluk et al., 2020). However, in wartime, the low level of investment activity of food production subjects in the absence of a complex of state incentives led to an increase in internal crisis processes and the inability to diversify investment processes due to global challenges and threats in the world. Currently, in the "stressful" war period, which, according to international financial organizations, has weakened its own model of forecasting the further development of the agro-food sector, led to the loss of some connections, complicated the timeliness of restoring investment in the resource component of agro-food provision, increased investment risks and weakened the position of the national market.

Therefore, the harmonization of relations regarding the restoration of a high level of confidence of foreign investors in large and medium-sized businesses in the agro-food industry, in particular in the matter of over-coming the informational opacity of the use of investment flows, should be regulated through the introduction of new reforms in the economy related to attracting resources to ensure

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investment opportunities of the sub-jects. These questions are considered in the works of classics such as: Bae and Goyal (2009), Brown et al. (2009), Filatova (2021), Irtysheva and Stehnei (2009), Ivanyshyn (2011), Katsan (2018), Kisil and Kozhemiakina (2012), Kravchun (2018a), Levchynskiy (2011), Lsobas (2012), Makukh (2009), Malskyi and Bilenko (2016), Muzychenko (2015), Trusova, et al. (2022). The problems of state regulation, formation and implemen-tation of investment policy, formation of the economic model of investment activity of subjects of the agro-food sector at the national level are discussed in scientific works of Kravchun (2018b), Lebid (2016), Mathe (2013), Melnyk et al. (2019), Miller and Coble (2008), Nechytailo (2011), Nehoda (2019), Nepochatenko and Bondarenko (2011), Nosova (2007), Smaliukh (2017), Trusova et al. (2021), Zhulavskii and Ko-bushko (2011).

The priority of our research is the substantiation of the financial toolkit, which in the resource distribution sys-tem of the public-private partnership institute changes the dominant sources of the investment flow according to the balanced value of their target use in order to restore and ensure the activation of investment opportunities of subjects of agro-food production.

## MATERIALS & METHODS

The methodology of the study of the financial dominance of the activation of investment opportunities of subjects of agro-food production of Ukraine includes a thorough analysis, systematization and study of financial aspects that affect the development and investment attractiveness of this sector. Methodological and theoretical studies of investment processes in the article are based on the principles of dialectics as a general method of cognition. To fulfill the set tasks, the authors used a number of methods, including: the method of logical generalization, systematic and complex approaches (in the study of the stages and components of the investment process), analysis and synthesis (in the study of directions for the activation of investment opportunities of subjects of agro-food production), the method of data summarization and comparative comparison (in the study of priority areas of activation of the investment process). In the course of a comprehensive and systematic approach, aspects of the financial condition and influence and investment activity of the financial sector were analyzed.

With the help of financial planning and analysis, the nominal level of profitability of the sources of investment from international partners in the distribution system of the public-private partnership institute was calculated for the needs of realizing the investment opportunities of agro-food producers. Using risk assessment methods and performance indicators to identify and manage risks associated with investment projects in the agri-food sector.

In the course of using financial models for forecasting the results of investment projects, analyzing options and optimizing financial decisions, a model of synergistic adaptation of the financial determinant in the own sources of the investment flow of agro-food production entities using Euler circles was proposed.

In the course of interaction with financial institutions, the estimated value of sources of investment for the renewal of agricultural machinery, mineral fertilizers of subjects of agro-food production of Ukraine was determined with the support of the Institute of Public-Private Partnership.

## RESULTS AND DISCUSSION

### Sources of the Investment Flow for the Restoration of the Investment Activity of the Subject of Agro-food Production

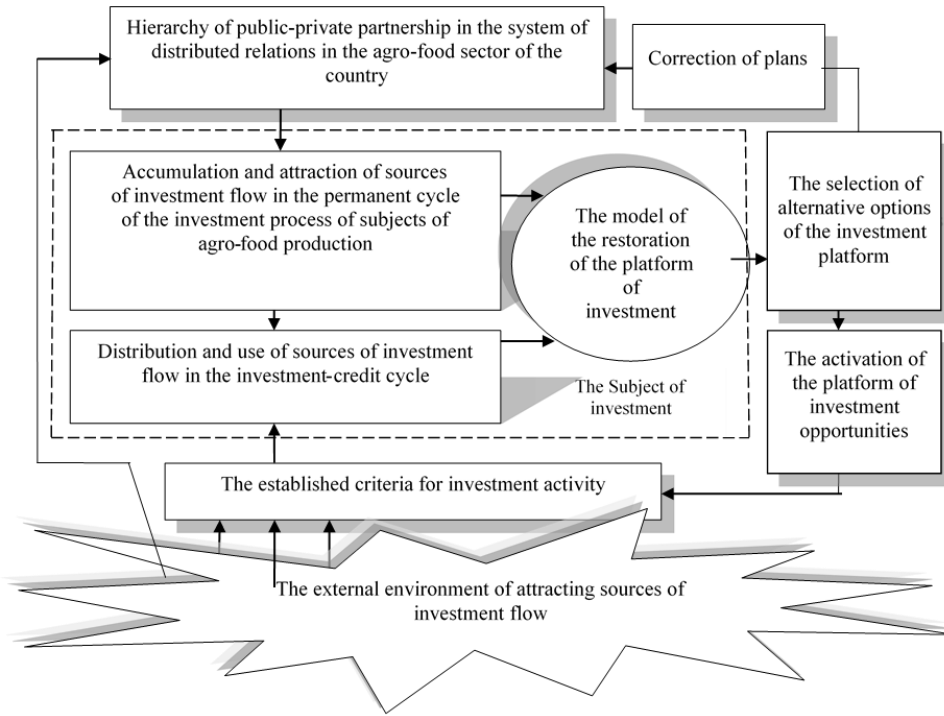
The potential of investment opportunities of subjects of agro-food production in each country has a unique institutional matrix peculiar only to it, which has a long-term, unchanging basis. This basis is supplemented by variable criteria of a distributive nature, according to the norms and rules of cooperation of agro-food production entities in public-private partnership, which modify the methods of evaluating the sources of investment flows to activate the platform of investment opportunities, which have an impact on the permanent nature of the investment process. That is, in the structure of the institutional matrix of public-private partnership, the platform of investment opportunities of subjects of agro-food production is formed with the help of a set of sources of investment flow, capable of attracting, accumulating, distributing and using them, which ensure the investment activity of subjects of agro-food production (Trusova et al., 2021b; Vorsovskiy, 2007) (Fig. 1).

The ability of the sources of the investment flow to move through the "platform" of the subject's investment opportunities allows us to distinguish five types of them (Fig. 2), which differ in the instruments of influence on the subject's investment activity. The target direction of the process of restoration of the platform of investment opportunities of agro-food production entities is the economic regulation of the duration of the investment-credit cycle, which is the time interval between the payment of the loan and interest for the purchase of raw materials, as well as covering investment costs for the manufacture and sale of products. It characterizes the period of service turnover of sources of investment flow for all types of activities of subjects of agro-food production (Makukh, 2009; Zhulavskii & Kobushko, 2011).

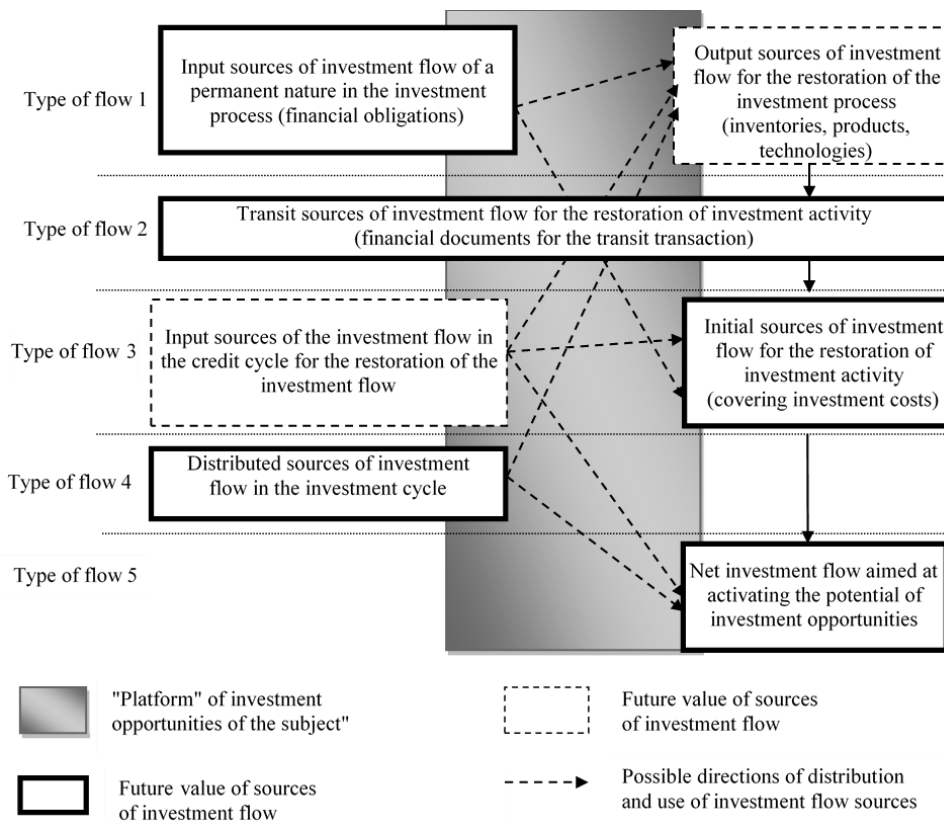
The targeted dynamics of the investment and credit cycle is a permanent factor in restoring the investment opportunities of the subject of agro-food production, which allocates the sources of the investment flow for their use in transactions (current calculations for stocks, finished products, technologies), transforming them into present and future value to activate the movement investment resources (Irtysheva & Stehnei, 2009; Lebid, 2016). That is, the faster the sources of the investment flow are transformed into an investment form, the higher will be the efficiency of their use to activate the investment activity of the subject of agro-food production. At the same time, the efficiency of using the sources of the investment flow is a criterion for influencing the permanent investment cycle, which is oriented towards the formation of 24.8% of the total amount of current income, taking into account the degree of investment risk in the initial period of recovery of the lack of own working capital invested in production stocks for standard (Brown et al., 2009; CGFS-FSB, 2017; Global investment platform convergence, 2014).

The typology of the sources of the investment flow for the restoration of the investment activity of the subject of agro-food production has a methodological justification, which is the implementation of the financial dominant, which is transformed in the system of distribution of the involved resources of the institute of public-private partnership according to the level of prediction and continuity of movement (Fig. 3).

Among the functional properties of the financial dominant of the sources of the investment flow, which activates the investment opportunities of the subject of agro-food production, it is necessary to highlight their speed of movement (Ivanyshyn, 2011; Kravchun, 2018a; Nechytailo, 2011).



**Fig. 1:** The model of restoration and activation of the platform of investment opportunities of agro-food production entities on the basis of the distribution of sources of the investment flow of the public-private partnership institute

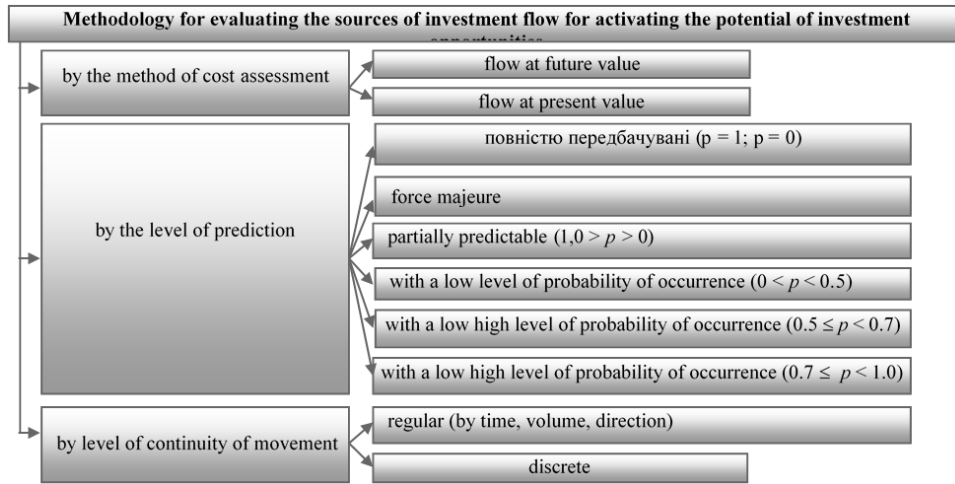


**Fig. 2:** The model of the movement of investment flow sources for the activation of the "platform" of investment opportunities of the subject of agro-food production

The speed of movement of the sources of the investment flow reflects the number of days in which it is able to move from the credit cycle (characterizes the permanent state of the investment process) to the investment cycle (characterizes the state of realizing the potential of investment opportunities ( $t_{1 \rightarrow 2}$ )) and the ability of the subject of agro-food production to fulfill obligations of communication with business partners. At the same time, the high speed of movement of the sources of the investment flow indicates a high level of investment activity of the subject of agro-food production

(Kovalchuk & Kozenkova, 2017; Nazarenko, 2015; Shevchenko, 2008).

The speed of movement of sources of investment flow is determined by their volume, and the time of movement is a reflection of their dynamic properties in the potential of investment opportunities of the subject of agro-food production. Accordingly, the strength of the movement of the sources of the investment flow reflects the amount of the flow of the credit cycle, which is transformed into an investment flow in order to activate the possibility of the subject of agro-food production per unit of time (Irtysheva & Stehnei, 2009; Lebid, 2016; Trusova et al., 2021b):



**Fig. 3:** Methodology for assessing the sources of investment flow for the activation of investment opportunities of subjects of agro-food production: Source: developed by the authors based on data Kovalchuk & Kozenkova, 2017; Nazarenko, 2015; Nehoda, 2019; Nepochatenko & Bondarenko 2011

$$v_{FF_j} = \frac{FF_j}{t_{1 \rightarrow 2}} \quad (1)$$

Where,  $FF_j$  – is the nominal amount of the j-th source of investment flow of the permanent state, USD;  $t_{1 \rightarrow 2}$  – the number of days in which the source of the investment flow will be able to move from a permanent state to a state of investment opportunities of the subject of agro-food production, days.

When assessing the level of investment activity of an agro-food production subject, it is necessary to calculate the coefficient of the speed of movement of the sources of the investment flow ( $K_{FF}$ ), which is defined as the ratio of the number of days required to receive a credit flow in the investment process of the subject ( $t_0$ ), in the presence of the right to overdraft, and the speed of transformation of the movement of the source of the investment flow from the credit to the investment cycle (Irtysheva & Stehnei, 2009; Lebid, 2016; Trusova et al., 2021b):

$$K_{FF} = \frac{t_0}{t_{1 \rightarrow 2}} \quad (2)$$

As a result of the calculation the index of activation of investment opportunities of the subject of agro-food production is determined, which ranges from absolute to conditional and reflects the qualitative criteria of the “diversification coefficient of the sources of the investment flow”  $k_{tr(\{j\})}$  which has limits: from 1.0 (absolute) to 0.5 (conditional) (Table 1).

Accordingly, taking into account the proposed index, the value of the sources of the investment flow over time is determined, which activate the investment opportunities of the subject of agro-food production according to the set of regular sources formed for its recovery (Irtysheva & Stehnei, 2009; Lebid, 2016; Trusova et al., 2021b):

$$FF_R = \sum_{t=1}^T \frac{\sum_{j=1}^N FF_{jt} \cdot k_{tr(\{j\})} \cdot P_{jt}}{(1 + \eta_{in,t})^t} \quad (3)$$

Where,  $p_{jt}$  – is the probability of the occurrence of the j-th source of investment flow in the t-th period,  $p_{jt} \in \{1,0\}$ , which is capable of increasing the platform of investment opportunities of the subject of agro-food production, unit shares;  $\eta_{in,t}$  – is a coefficient that takes into account the index of the rate of return acceleration of alternative investments in the t-th period of the movement of the sources of the investment flow, passing from the credit state to the investment state, unit shares.

Thus, the index of activation of investment opportunities of the subject of agro-food production  $Y(FF_j)$ , includes a set of regular flows  $\{Y_p\}$  in the investment cycle, under the condition that the j-th flow belongs to the same type of set of flows  $\{M\}$ , which are distributed according to by the synchronicity of their use ( $FF_j$ ) from the investment source and by the rhythmic of the transition to flows with a fast time interval ( $t_{FF_j}$ ), or with a distribution interval ( $t_{Y_p}$ ) between the flows of the set  $\{Y_p\}$  (Irtysheva & Stehnei, 2009; Lebid, 2016; Trusova et al., 2021b):

$$Y(FF_j) \in \{Y_p\} \text{ if } j \in \{M\}, FF_j = FF_p, t_{FF_j} = t_{Y_p} \quad (4)$$

Then, the cost of sources of restoration of investment opportunities of the subject of agro-food production ( $C_{mv,j}$ ) includes several components (Levchynskyi, 2011; Skvortsov, 2023):

$$C_{mv,j} = C_{f,j} + C_{s,j} + C_{ad,j}^{int} + C_{ad,j}^{ext} \quad (5)$$

where,  $C_{f,j}$  – is the value of the j-th source of investment flow (the amount of additional output flow related to the execution and conclusion of the contract, compliance with the requirements of the financial market institute, commission fees to intermediaries), USD;  $C_{s,j}$  – service cost of the j-th source of investment flow (volume of additional output flow, which ensures the transition to the

**Table 1:** Scale of the index of activation of investment opportunities of the subject of agro-food production  $Y(FF_j)$ 

Speed ( $t_{1 \rightarrow 2}$ )	Speed coefficient $K_{FF}$	Index of activation of investment opportunities $Y(FF_j)$	Diversification coefficient of investment flow sources $k_{ir(j)}$
1 – 2	1.000 – 0.500	Absolute	1.00
2 – 10	0.490 – 0.100	High	0.98
11 – 30	0.099 – 0.033	Limited	0.95
31 – 60	0.032 – 0.017	Medium	0.90
61 – 120	0.016 – 0.009	Low	0.80
121 - 270	0.009 – 0.004	Weak	0.70
> 270	<0.003	Conditional	0.50

Source: compiled by the authors based on data (Irtysheva & Stehnei, 2009; Lebid, 2016; Trusova et al., 2021b)

investment process from the corresponding investment source (commission payments for flow maintenance), USD;

$C_{ad,j}^{int}, C_{ad,j}^{ext}$  – possible additional losses, related to internal and external factors influencing the j-th sources of investment flow, USD.

In order to activate the sources of the investment flow and their movement on the platform of investment opportunities of the subject of agro-food production, that is, to determine their value, the “relative index of activation of the sources of the investment flow” is calculated – the ratio of the value of the sources of the investment flow directed to the restoration of the investment process (cycle) to the total amount of flows entering the economic cycle of the subject of agro-food production (Levchynskiy, 2011; Skvortsov, 2023):

$$c_{mv,j} = \frac{C_{f,j} + C_{s,j} + C_{ad,j}^{int} + C_{ad,j}^{ext}}{FF_j} \quad (6)$$

The relative index of activation of sources of investment flow should be calculated for each incoming flow. At the same time, the financial dominant of the involved sources of loan resources in the permanent investment cycle identifies the value of each of the transitive tranches of the sources of the investment flow (Skvortsov, 2023). This indicator within the framework of the public-private partnership institute is determined by profitability and risk criteria. They form the investment opportunities of agro-food production entities in the region in order to obtain the maximum level of profitability from the placement of investments with a minimal risk of losing the invested capital or part of it. It is quite logical that the economic activity of subjects of agro-food production is attractive from the position of a potential investor, if the maximum level of profitability is ensured with a minimum level of risk according to the  $\beta$ -coefficient criterion, which is determined by formula (7), (Global investment platform convergence, 2014; Makukh, 2009; Nehoda, 2019; Nosova, 2007):

$$\beta_i = \frac{Cov(D_i, D_m)}{\sigma^2(D_m)} = \frac{\sum_{j=1}^n (D_{mj} - \bar{D}_m)(D_{ij} - \bar{D}_i)}{\sum_{j=1}^n (D_{mj} - \bar{D}_m)^2} \quad (7)$$

Where,  $D_i, D_m$  – is the profitability of subjects of agro-food production in the i-th region and the average profitability of the agro-food industry in the country;  $Cov(D_i, D_m)$  – covariance of the profitability of agro-food production entities of the i-th region and the average profitability of the agro-food industry in the country;  $\sigma^2(D_m)$  – variance of the country's average profitability of the agro-food industry; – the

number of studied periods;  $D_{ij}, D_{mj}$  – is the profitability of

subjects of agro-food production in the i-th region and the average profitability of agriculture for the j-th period.

The level of activation of the sources of the investment flow for realizing the investment opportunities of agro-food production subjects in the industry in a certain territory, provided that the public-private partnership institute is involved in this process, is considered normal when the risk is low ( $\beta \leq 0$ ) or moderate ( $0 \leq \beta \leq 1$ ), and therefore is attractive for investors. The coefficient ( $\beta \geq 1$ ) indicates a high level of risk of recovery of investment opportunities; the relative index of activation, which is activated to restore the investment opportunities of subjects of agro-food production in the industry in a certain territory, is unstable, prone to fluctuations (Global investment platform convergence, 2014; Ivanyshyn, 2011; Nehoda, 2019; Nosova, 2007).

The scale for assessing the level of activation of sources of the investment flow for the realization of investment opportunities of subjects of agro-food production in the region according to the criteria “profitability – risk” is given in Table 2.

In the combined actions of the public-private partnership institute, which arise when the sources of investment flow are activated and the investment opportunities of agro-food production entities are realized, the distribution and control function of the movement of flows according to the target use in the investment cycle aimed at the restoration of technological equipment is formed (Ivanyshyn, 2011). This significantly reduces the risk of non-return of investments, due to the division of the total amount of sources of investment flow into shares in order to preserve the right of ownership for the acquisition of assets and their further use. In addition, activation of investment opportunities (transition from the stage of attracting loan resources to an investment transaction) allows creating additional guarantees of return of invested own resources (Global investment platform convergence, 2014; Trusova et al., 2022).

To estimate the cost of sources of investment flows that activate the investment opportunities of agro-food production entities at the macro level, the indicator of financial support of producers at the expense of the public-private partnership institute is used.

The indicator of financial support for producers (IFSP), measures the annual value of redistributed budget investment flows for the development of subjects of the agro-food industry and determines the share (“threshold”) of potential assistance for the activation of investment opportunities, regardless of their branch affiliation, goals or income. The values of IFSP are calculated by adding to the support of market prices the share of the flow of budgetary investment directed to producers (Global investment platform convergence, 2014; Ivanyshyn, 2011; Miller & Coble, 2008; Muzychenko, 2015; Trusova et al., 2022).

**Table 2:** Matrix of activation of investment flow sources for implementation of investment opportunities of agro-food production entities according to the evaluation criteria "profitability – risk"

Profitability	Risk level		
	Low ( $\beta \leq 0$ )	Moderate ( $0 \leq \beta \leq 1$ )	High ( $\beta \geq 1$ )
Low	Unattractive	Unattractive	Unattractive
Medium	Very attractive	Attractive	Attractive
High	Very attractive	Very attractive	Very attractive

Source: created by the authors based on data (Global investment platform convergence, 2014; Ivanyshyn, 2011; Nehoda, 2019; Nosova, 2007)

$$IFSP = (P_i^d - P_i^b) + (S_i - T_i), \quad (8)$$

where,  $P_i^d$  – is the internal price of sources of investment flow to support producers of agro-food products;  $P_i^b$  – world price of sources of investment flow to support producers of agro-food products;  $S_i$  – direct budget investments in support of producers of agro-food products;  $T_i$  – direct taxes of producers of agro-food products.

The composite indicator is a relative value IFSP, that shows the share of the flow of budgetary investment in support of producers of agro-food products in the value of their net investment income (Global investment platform convergence, 2014; Ivanyshyn, 2011; Miller & Coble, 2008; Muzychenko, 2015; Trusova et al., 2022).

The relative value (%IFSP) is calculated according to formula (9) (Global investment platform convergence, 2014; Ivanyshyn, 2011; Miller & Coble, 2008; Muzychenko, 2015; Trusova et al., 2022):

$$\%IFSP = \frac{IFSP}{\sum_i P_i^d Q + (S_i - T_i)} \times 100\%, \quad (9)$$

Where,  $\sum_i P_i^d Q$ , – is the cost of investment flow sources in domestic prices.

In the global investment market %IFSP = 20% means that 20% of the net investment income of producers of agro-food products was formed from the distributed amount of budget investment flows (financial support) of the public-private partnership institute; %IFSP = 0% – the amount of flows from the institute of public-private partnership was not distributed to support producers of agro-food products, because their investment activity is carried out at the expense of their own resources and exceeds the average threshold level of financial support (Global investment platform convergence, 2014; Ivanyshyn, 2011; Miller & Coble, 2008; Muzychenko, 2015; Trusova et al., 2022).

### Subjects of Agro-food Production of Ukraine before the start of a Full-scale War

Subjects of agro-food production of Ukraine, before the beginning of the full-scale invasion of the aggressor country on the territory of the state, steadily increased investment activity. At the same time, the level of investment opportunities increased annually to 5-6%, the share of their contribution to the country's GDP was 10%, and together with the processing industry – 16% (Investment climate in Ukraine, 2023). Despite the crisis circumstances in Ukraine's agro-food industry, it continues to provide a volume of trade equivalent to 6% of world consumption calories (Prokopenko, 2020; Shevchenko, 2009). Ukraine is the leader in international trade in sunflower oil (first place in the world), rapeseed and barley (third and fourth places,

respectively) and other products. By 2022, trade in agro-food products brought Ukraine about 22 billion USD annually and accounted for 41% of all exports (OECD International Direct Investment Statistics for 2014-2021, 2022). In 2022, mutual trade in agro-food products between Ukraine and EU countries amounted to 16.5 billion USD. In relation to the level of 2021, this indicator increased by 39% during the period of validity of the Association Agreement between Ukraine and the EU (in 2021 it amounted to 11.9 billion USD). European partners for Ukraine in 2022 were Poland, Romania, Spain, the Netherlands, Italy, Germany and Hungary. These countries made up 77% of the total Ukrainian trade turnover of agro-food products with the European Union (State Statistics Service of Ukraine, 2021; Information on investment projects implemented in the agricultural industry, 2023; Investment climate in Ukraine, 2023; KSE Institute, 2023; OECD International Direct Investment Statistics for 2014-2021, 2022).

In 2022, Ukraine imported agro-food products from EU member states in the amount of about 3.38 billion USD, which is almost 17% less than in 2021. The import of agro-food products to Ukraine from EU member countries lacks a permanent structure. At the same time, several groups of goods stand out, for example, milk products accounted for, 6% of Ukrainian imports from the EU in 2022. However, in relation to 2021, this group of goods decreased by 35% and by the amount of 219 million USD. The main product in the import of this group is cheese – 180 million USD. The supply of ready-made grain products to the Ukrainian market amounted to 207 million USD, meat – 207 million USD, vegetables – to 183 million USD. In general, according to the specified groups of products, they make up 57% of the value of agro-food imports from EU member states (Capital investments by sources of financing for 2006-2020, 2021; Capital investments by sources of financing for 2021, 2022; Information on investment projects implemented in the agricultural industry, 2023).

In 2022, the volume of poultry meat exports decreased by 10% – to 413 thousand tons. At the same time, the cost of its sale increased by 19% (853 million USD). In 2022, subjects of agro-food production of Ukraine managed to increase the income from the export of meat and offal by 9% – up to 925 million USD. Geographical diversification of the export of meat and by-products of Ukrainian production is carried out to the countries of the Middle East, other parts of Asia, EU countries and Africa. At the same time, the share of exports to EU countries in 2022 was 39%. For example, the Netherlands, which in 2017-2019 was in the TOP-10 EU countries for the purchase of agro-food products from Ukraine, in 2022 increased its rating (up to 27.3% of Ukrainian exports of meat products in the amount of 252 million USD). In the second place is Saudi Arabia. In 2020, poultry meat was exported from Ukraine to Saudi Arabia in the amount of 136 million USD (83 thousand tons), in 2022 p. – increased by 23.8% to 220 million USD (81 thousand tons of poultry meat). In 2022, the share of exports to Slovakia from Ukraine equaled 7%, China – 4.8%, UAE – 4.5%, Turkey – 3.6%. In general, these countries allowed to increase the income of subjects of agro-food production up to 71% from the sale of Ukrainian

meat on the world market (State Statistics Service of Ukraine, 2021; Information on investment projects implemented in the agricultural industry, 2023; KSE Institute, 2023; OECD International Direct Investment Statistics for 2014-2021, 2022).

Despite partially positive changes in the activity of agro-food production entities of Ukraine during the military aggression of the terrorist country, it was not allowed to fully restore the potential of investment opportunities of agro-food production entities in the institutional matrix of public-private partnership. This caused negative consequences in the joint-distributive system of the movement of sources of the investment flow, which effectively adjusted the dynamics of investment activity of subjects of agro-food production through the investment and credit mechanism. Before the beginning of the full-scale military invasion of the aggressor country, the coordinate system of the movement of sources of investment flows had a balanced differential in the exchange of resources between interested participants in the investment process (Fig. 4).

The distribution structure of the movement of the sources of the investment flow of the public-private partnership institute is coordinated to search for external and internal investments under the financial support program "Available loans of 5-9% for subjects of agro-industrial production of Ukraine". It was implemented in 2020 to reduce the credit burden on the own resources of agro-food producers and to direct them to restore the investment cycle in the latest technologies (Fig. 5).

This made it possible, on the one hand, to preserve assets, and on the other hand, to attract foreign partners to the agro-food industry of Ukraine, focused on improving recovery proportions in the national production segment. The variable component of the distribution of the sources of the investment flow of the public-private partnership institute in support of agro-food production entities in Ukraine from 2021 is shown in Fig. 6.

It should be noted that the transformation of the financial dominant of the sources of investment flows of the public-private partnership institute contributes to increasing the investment opportunities of subjects of agro-food production. During the period of 2018-2020, the institute of public-private partnership financed 444 investment projects in the amount of 40.6 billion USD for the investment needs of the subjects; in 2021 the volume of investment flows from the institute amounted to 201.81 billion USD (393 investment projects were implemented) (Capital investments by sources of financing for 2006-2020, 2021; Capital investments by sources of financing for 2021, 2022). It should be noted that during the wartime, in Ukraine, there is a decrease in the monthly income from the export of agro-food products – from 6-7 million USD to 1.5 million USD. This leads to a fall in domestic prices for products, which in the war period are below the cost level. Such consequences provoked the threat of loss of investment opportunities due to the financial inability of most agro-food entities to carry out the process of reproduction of production and technological assets.

Direct losses of assets in the industry amounted to 6.5 billion USD. During the hostilities, about 5% agricultural land was damaged, 75% of irrigated land, 25% of irrigated land, about 20% of garden area and 25% of the area under berry crops were lost. Agricultural, warehouse, transport, energy infrastructure and processing industry facilities suffered significant destruction. In the war zone, up to. Agricultural, warehouse, transport, energy infrastructure and processing industry facilities suffered significant destruction. In the war zone, up to 30% of the animal population is potentially lost (KSE Institute, 2023).

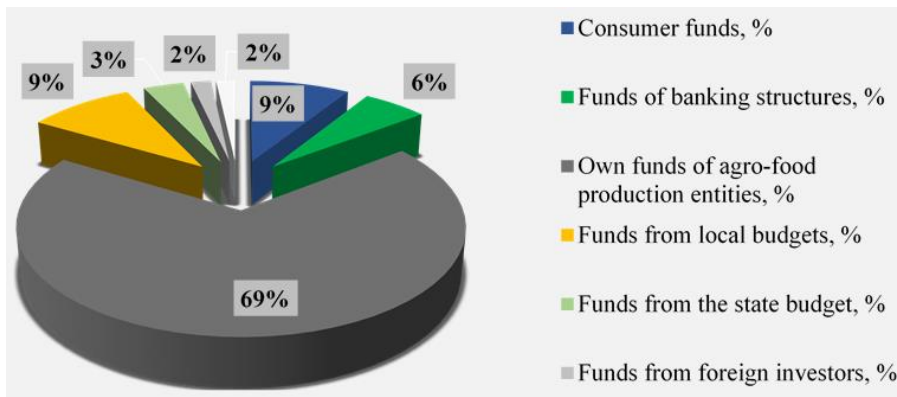
Before the war conflict, in the distribution system of the movement of sources of investment flow from the institute of public-private partnership, for the restoration of investment opportunities of subjects of agro-food production, subsidy support for compensation of the gap between the income received from production and export of products increased on average up to 10.4-10.7%. That is, in 2018-2021, a positive trend towards the convergence of the value of the relative index of activation of the sources of the investment flow, aimed at supporting the investment process (cycle) of agro-food production entities between Ukraine and the EU countries, emerged. Unfortunately, in 2022, entities in Ukraine were left without state support 0.8% of budget investment from the planned amount of net investment income was not received (Fig. 7). This led to a negative value of the index, which is associated with an increase in the payment of taxes to the budget, which were provoked by differences between domestic prices in the country in relation to export prices, due to the unsystematic regulation of prices for products of the agro-food industry. In Ukraine, only in 2017-2018 the financial support of the public-private partnership institute in the domestic market was stable in relation to the world level.

In the structure of the distribution of the sources of the investment flow from the public-private partnership institute, which were aimed at supporting producers of agro-food products (IFSP) in Ukraine, in addition to supporting market prices, a significant share of state subsidies is occupied by payments related to production volumes – 2.7% (compared to 2015, the share of financial flows in the form of investment subsidies decreased by 20.5 percentage points in 2021) and payments related to the use of production and technical resources – 9.5% (for 2015-2021, the share of investment subsidies increased by 18.5 percentage points). (Fig. 8).

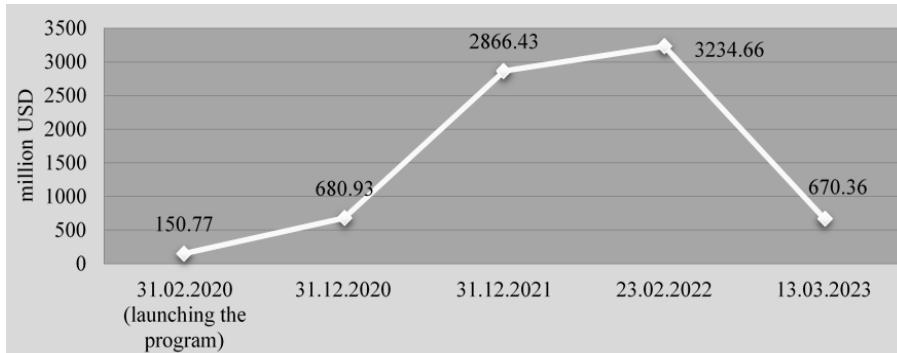
The accumulated value of the sources of the investment flow was primarily aimed at covering VAT, partial compensation of the cost of own resources in investment projects for the construction and reconstruction of livestock farms, new greenhouse complexes, costs for the purchase of individual milking installations for individuals; support of viticulture, horticulture; selection. In the structure of budgetary investment, this component occupies 78% of the country's total subsidy flow for the restoration and activation of investment opportunities of manufacturers.

The level of activation of sources of investment flow for the realization of investment opportunities of subjects of agro-food production in the industry depends on the ratio between the average cost of flows directed through the investment and credit mechanism of the public-private partnership institute, with the involvement of international organizations in this process (Shevchenko, 2009). This indicator demonstrates the influence of international investment funds on the formation of a national policy to accelerate the investment development of entities in a certain industry, by directing the sources of the investment flow to the needs of producers of agro-food products. If the indicator is greater than one, it means that, in fact, the average hidden tax rate on input investment capital is directed to support producers (Fig. 9).

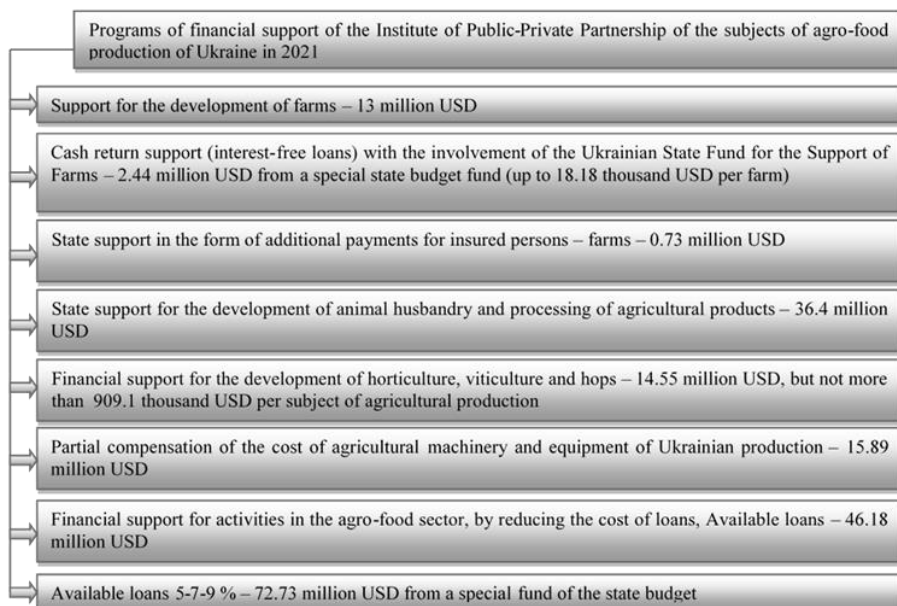
Thus, for the period of 2015-2021, the main foreign investors in the institute of public-private partnership of Ukraine, which directed the sources of the investment flow to the activation of investment opportunities of subjects of agro-food production, were international organizations of such countries as: the Netherlands, Germany, Turkey, Italy, Spain, Romania. Among the studied countries, international organizations from the Netherlands, Germany and Turkey had the highest value of the nominal level of profitability from the incoming sources of the investment flow,



**Fig. 4:** The structure of the sources of the investment flow for the restoration of the platform of investment opportunities of subjects of agro-food production of Ukraine in 2021, %



**Fig. 5:** Financial support program of the Institute of Public-Private Partnership "Affordable loans of 5-9% for subjects of agro-food production of Ukraine" in 2020-2023, million USD; Source: built by the authors according to data (Statistical collection: "Budget of Ukraine 2018", 2018; Statistical collection: "Budget of Ukraine 2020", 2021; Statistical Publication "Ukraine in Figures", 2021; Statistical Yearbook of Ukraine, 2021)



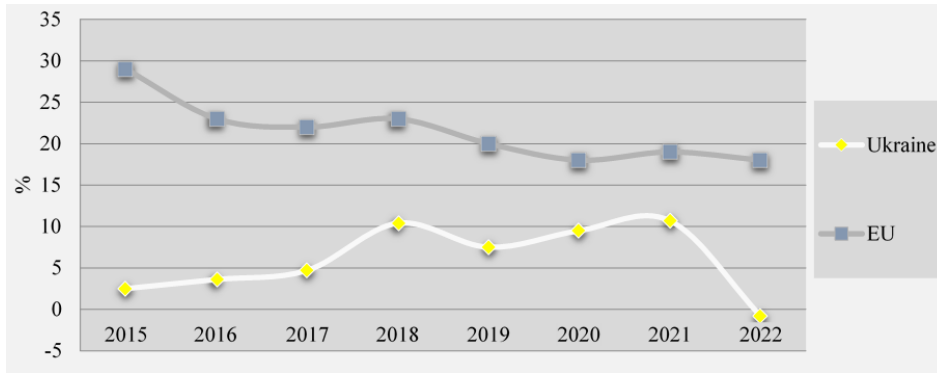
**Fig. 6:** Current financial support programs of the public-private partnership institute for subjects of agro-food production in Ukraine in 2021; Source: built by the authors according to data (Statistical collection: "Budget of Ukraine 2018", 2018; Statistical collection: "Budget of Ukraine 2020", 2021; Statistical Publication "Ukraine in Figures", 2021; Statistical Yearbook of Ukraine, 2021)

which were distributed through the institute of public-private partnership of Ukraine and aimed at supporting the investment opportunities of subjects of agro-food production. Their return on investment for 2015-2018 was 62%, 38% and 54% respectively; for 2019-2021, the average share of profitability increased by 6%, 2% and 3% respectively. In the structure of internal sources of investment flows from Ukrainian partners, their share of profitability in 2015-2018 was only 9%, which increased to 15% in 2019-2021. That is, there is a dependence of the activation of the investment cycle of Ukrainian agro-food production entities on the sources of investment flows of international organizations, which support the balance in the investment and credit mechanism for updating production and technical assets (Statistical collection: "Budget of Ukraine 2018", 2018; Statistical collection: "Budget of Ukraine 2020", 2021; Statistical Publication "Ukraine in Figures", 2021; Statistical Yearbook of Ukraine, 2021).

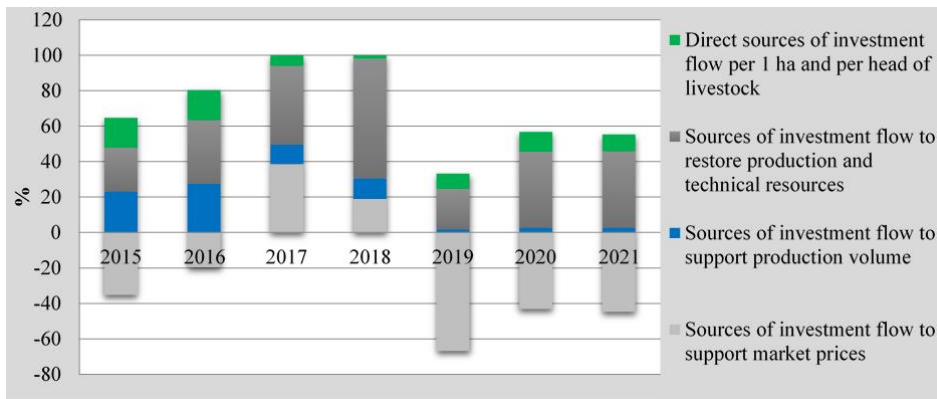
### The Financial Dominant of the Incoming Sources of the Investment Flow on the Platform of Investment Opportunities

The financial dominant of input sources of the investment flow on the platform of investment opportunities of agro-food production entities is a qualitative tool for their adaptation to the influence of the external environment to attract resources. Its characteristic represents an emergent property that is limited in the current permanent period by its own resources (Kisil & Kozhemiakina, 2012). Therefore, ensuring a successful combination of the distribution of investment flow sources through the institution of public-private partnership must meet the requirements and regulations that determine the criteria for the investment activity of agro-food production entities in the investment process and their desire to compete on the market in the presence of multiple identical investment flows (Sokolov & Mykhailov, 2017; Trusova et al., 2022; Vorsovskyi, 2007).

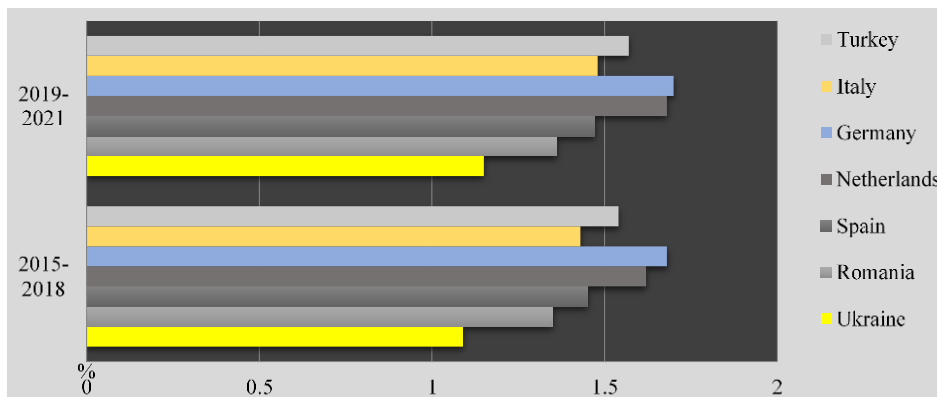




**Fig. 7:** Relative index of activation of investment opportunities of agro-food production subjects under the conditions of financial support of the public-private partnership institute in Ukraine and EU countries for 2015-2022, %; Source: built by the authors according to data (Statistical collection: "Budget of Ukraine 2018", 2018; Statistical collection: "Budget of Ukraine 2020", 2021; Statistical Publication "Ukraine in Figures", 2021; Statistical Yearbook of Ukraine, 2021)



**Fig. 8:** The structure of the distribution of sources of the investment flow of the public-private partnership institute aimed at supporting producers of agro-food products (IFSP) in Ukraine for 2015-2021, %; Source: built by the authors according to data (Statistical collection: "Budget of Ukraine 2018", 2018; Statistical collection: "Budget of Ukraine 2020", 2021; Statistical Publication "Ukraine in Figures", 2021; Statistical Yearbook of Ukraine, 2021)



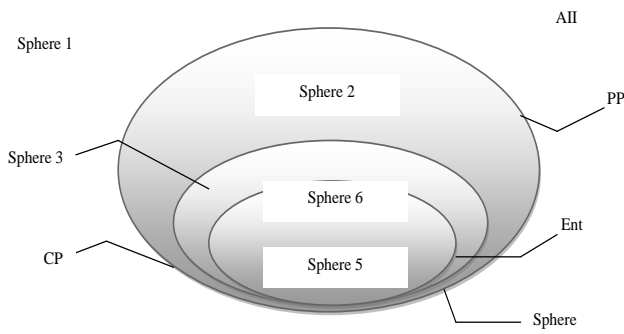
**Fig. 9:** The nominal level of profitability of sources of investment flow from international partners in the distribution system of the institute of public-private partnership for the needs of realizing investment opportunities of producers of agro-food products (%IFSP) for 2015-2021, %; Source: built by the authors according to data (Statistical collection: "Budget of Ukraine 2018", 2018; Statistical collection: "Budget of Ukraine 2020", 2021; Statistical Publication "Ukraine in Figures", 2021; Statistical Yearbook of Ukraine, 2021)

This makes it possible to identify the advantages of the cooperation of agro-food production entities with the public-private partnership institute and on the other hand, to determine real and potential opportunities for increasing one's own sources of investment flow, taking into account the influence of changing factors of the external environment.

The ability of subjects of agro-food production to accumulate their own sources of investment flows, which,

according to qualitative criteria, enable the realization of their internal reserves, allows building a model of synergistic adaptation (Fig. 10) and determining the properties of the financial dominant, taking into account the complex structure of the distribution of internal investment flows, using the tools of Euler (Ivanyshyn, 2011; Katsan, 2018; Kovalchuk & Kozenkova, 2017).

Using the tool involves the introduction of conditional definitions (Kovalchuk & Kozenkova, 2017; Nehoda, 2019).



**Fig. 10:** Model of synergistic adaptation of the financial dominant in own sources of investment flow of agro-food production entities using Euler circles; Source: constructed by authors according to data Kovalchuk & Kozenkova, 2017; Nehoda, 2019

$$AII = \{P\} \quad (10)$$

Where,  $AII$  – is the value of own sources of investment flow at domestic market prices.

The presented rings include a number of sets and subsets that require additional detailing. Sphere 1 is an area definitions (Kovalchuk & Kozenkova, 2017; Nehoda, 2019):

$$PP^- \cap Ent^- \cap CP^- \quad (11)$$

where –  $PP^-$ ,  $Ent^-$ ,  $CP^-$  – is the complement of the set to the set of all possibilities of the external environment. That is,

$$Sphere1 = \{P \mid (P \notin PP) \wedge (P \notin Ent) \wedge (P \notin CP)\} \quad (12)$$

Sphere 2 is an area  $PP \cap Ent^- \cap CP^-$ , which includes all the opportunities of the external environment that can potentially be used, but are not used and do not belong to the set of own sources of investment flows in the investment capital platform (Britchenko & Saienko, 2017; Abrahm et al. 2018):

$$Sphere2 = \{P \mid (P \in PP) \wedge (P \notin Ent) \wedge (P \notin CP)\} \quad (13)$$

Sphere  $PP \cap CP \cap Ent^-$  3 is represented by the area, which includes the opportunities of the external environment, which act as a financial dominant, which is not realized in the platform of investment opportunities of the subject of agro-food production regarding the activation of own sources of investment flow (Kovalchuk & Kozenkova, 2017; Nehoda, 2019):

$$Sphere3 = \{P \mid (P \in PP) \wedge (P \in CP) \wedge (P \notin Ent)\} \quad (14)$$

Sphere 4 is an area  $PP^- \cap Ent \cap CP^-$ , that represents a set of opportunities for the subject of agro-food production to activate the financial dominant of its own sources of investment potential, which cannot be realized within the framework of the external environment. This element is defined as a reserve for the future growth of the investment activity of the subject of agro-food production on the market (Kovalchuk & Kozenkova, 2017; Nehoda, 2019):

$$Sphere4 = \{P \mid (P \in PP) \wedge (P \in CP) \wedge (P \in Ent)\} \quad (15)$$

Sphere 5 is an area  $PP^- \cap Ent \cap CP$ , which includes real reserves (own reserves) of the subject of agro-food production, which are not used in the investment cycle and cannot be distributed in the system of accumulated investment capital (Kovalchuk & Kozenkova, 2017; Nehoda, 2019):

$$Sphere5 = \{P \mid (P \notin PP) \wedge (P \in CP) \wedge (P \in Ent)\} \quad (16)$$

Sphere 6 is an area  $PP \cap Ent \cap CP$ , that represents a part of the own sources of the investment flow, used within the framework of accumulated capital and is the most effective for activating the level of investment opportunities of the subject of agro-food production and receiving additional income for existing investment costs (Kovalchuk & Kozenkova, 2017; Nehoda, 2019):

$$Sphere6 = \{P \mid (P \in PP) \wedge (P \in CP) \wedge (P \in Ent)\} \quad (17)$$

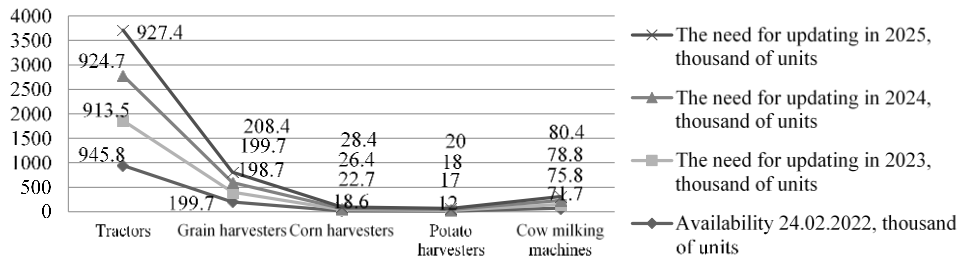
The level of efficiency in the use of investment capital of the agro-food production entity is proposed to be defined as the ratio of the use of part of the own sources of the investment flow to the total value of the accumulated sources of the investment flow with the support of the public-private partnership institute (Kovalchuk & Kozenkova, 2017; Nehoda, 2019):

$$ECP = Sphere6CP \quad (18)$$

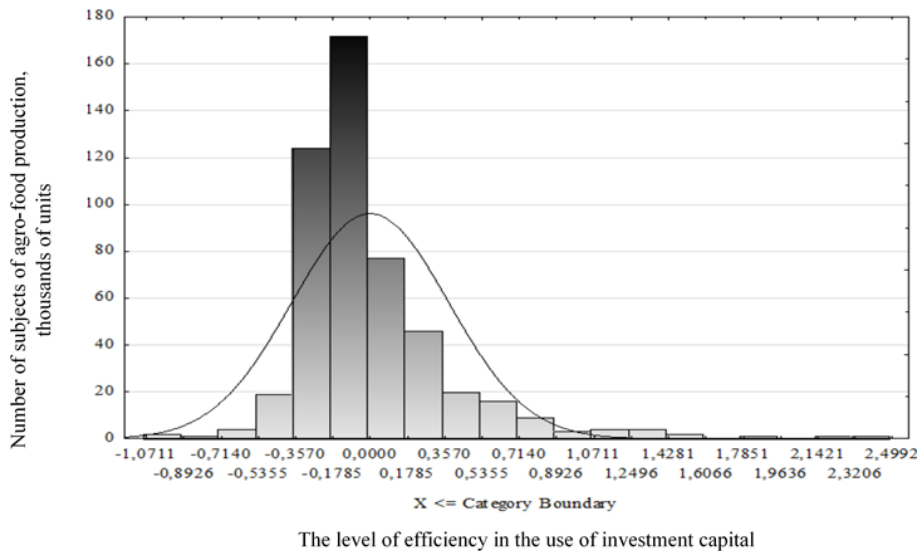
In the conditions of limited resources for the activation of investment opportunities of agro-food production entities of Ukraine, caused by the state of war in the country, there is a need to diversify the financial dominant, which takes into account both the producers' own sources of investment flow, and the sources of the investment flow of the public-private partnership institute, for intensive restoration of agricultural lands, as well as the material base in the fields of animal husbandry and crop production, namely: purchase of agricultural machinery and combines, installations and aggregates for milking cows, purchase of productive livestock, planting material of perennial crops and production stocks (seeds, fertilizers). Recovery requires 90% of the property potential of agro-food production entities to the level of 2021 (Fig. 11). It should be noted that only in 2022, in relation to 2021, that is, during the period of the full-scale invasion of the aggressor country on the territory of Ukraine, the number of tractors decreased almost 2.5 times, grain harvesters – 2.5 times, corn harvesters – 5.3 times, potato harvesters – almost 4.0 times (TOP-12 foreign investments in Ukrainian agribusiness, 2023).

At the end of 2022, for most subjects of agro-food production of Ukraine (34%) the value of the level of efficiency of the use of investment capital for the restoration of agricultural machinery is equal from -0.191 to -0.018. The interval of the indicator in the range from -0.018 to -0.369 corresponds to 24.4% producers of agro-food products. The value of the indicator above the average is typical for 30.2% of manufacturers (Fig. 12).

That is, for 2023-2025 58.4% producers are not able to accumulate their own sources of investment flow in the exact range of qualitative assessment of the level of efficiency of the use of investment capital for the restoration of agricultural machinery and milking facilities.



**Fig. 11:** Provision as of 24.02.2022 and the need for updating for 2023-2025 agricultural machinery of subjects of agro-food production of Ukraine.



**Fig. 12:** Distribution of the level of efficiency in the use of investment capital of agro-food production entities of Ukraine for the restoration of agricultural machinery for 2023-2025.

Accordingly, there is a need to regulate the law of normal distribution of sources of investment flow of agro-food production entities through financial support of the public-private partnership institute, in part of 56% of the budget investment for the restoration of agricultural machinery (Trusova et al., 2021).

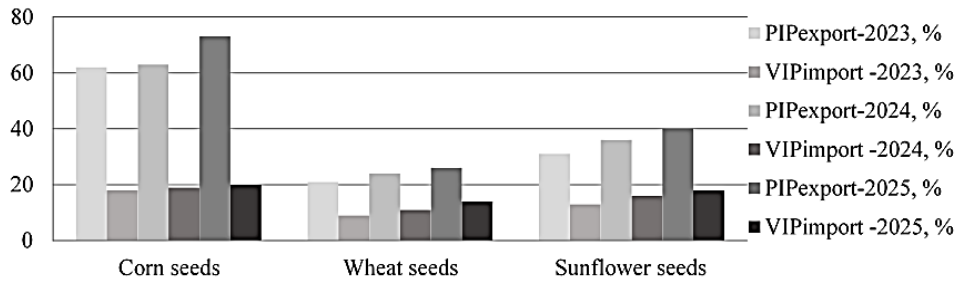
Another important stage of accumulation of sources of investment flow of subjects of agro-food production is the restoration of seed stocks in the field of crop production. Its role is determined by the ability to increase the yield by 20-30% in the short term due to the introduction of new high-yielding varieties of agricultural crops that are adapted to the conditions of the agro-climatic zones of Ukraine. In addition, the cost of seeds is a financial dominant of production stocks, the specific weight of which is from 6% to 25% of the structure of own sources of investment flow in the total accumulated flow distributed by subjects of agro-food production.

The forecast trend of the sources of the investment flow of agro-food production entities has a characteristic growth in 2023-2025. So, its volume in 2023 will be 2.15 million USD, in 2024 – 4.35 million USD, in 2025 – 9.8 million USD. The distribution structure has characteristic features: the largest share of sources of own investment resources 40% will be directed to the purchase of corn seeds; the second place is occupied by grain crops and sunflower – 20% and 16% respectively. This is due to the fact that producers of grain crops and sunflower often use their own raw material base; corn requires separate selection, taking into account its reproductive function. These circumstances affect the export and import of seeds (Fig. 13). The share of own sources of the investment flow of subjects of agro-food

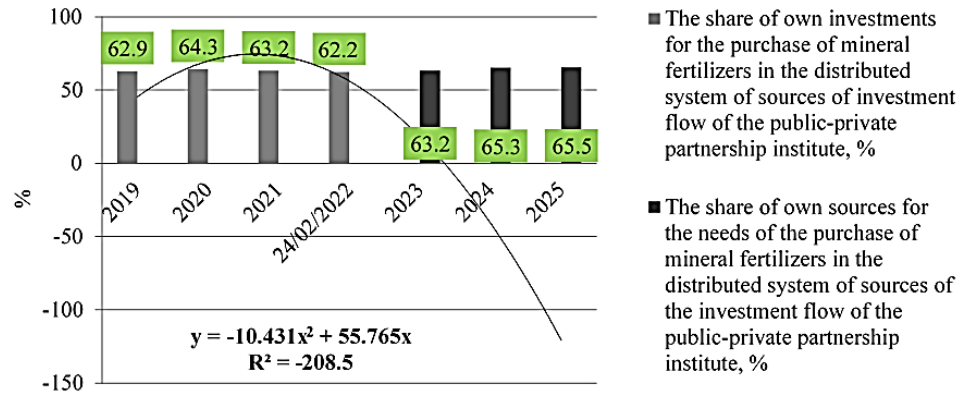
production from the export of corn seeds is forecast for 2023 in the amount of 62%, in 2024 – 63 %, in 2025 – 73%. In 2023-2025, the share of own investment flow from the export of sunflower seeds will increase by 31%, 36% and 40% respectively. A significant increase in the share of own investment resources from the export of wheat seeds is forecast – by 21%, 24% and 26% respectively.

Significant changes in the part of corn imports for 2023-2025 will reduce the own investment flow by 18%, 19% and 20% respectively, the import of sunflower seeds will accelerate the reduction of the flow by 13%, 16% and 18% respectively; import of wheat – by 9%, 11% and 14% respectively. It should be noted that there are more than 9000 varieties of plants in the Register of Ukraine, while the share of foreign varieties is 57%, national varieties – 43%. Since financial support from the institute of public-private partnership for the development and breeding of new varieties of plants is significantly limited, their reproduction takes place only at the expense of old varietal hybrids of national origin, the cultivation of which has become unsuitable in the agro-climatic zones of Ukraine. Import dependence complicates the existing situation together with the existing market structure: 70% of the market is owned by 10 leading importers, which are multinational seed companies.

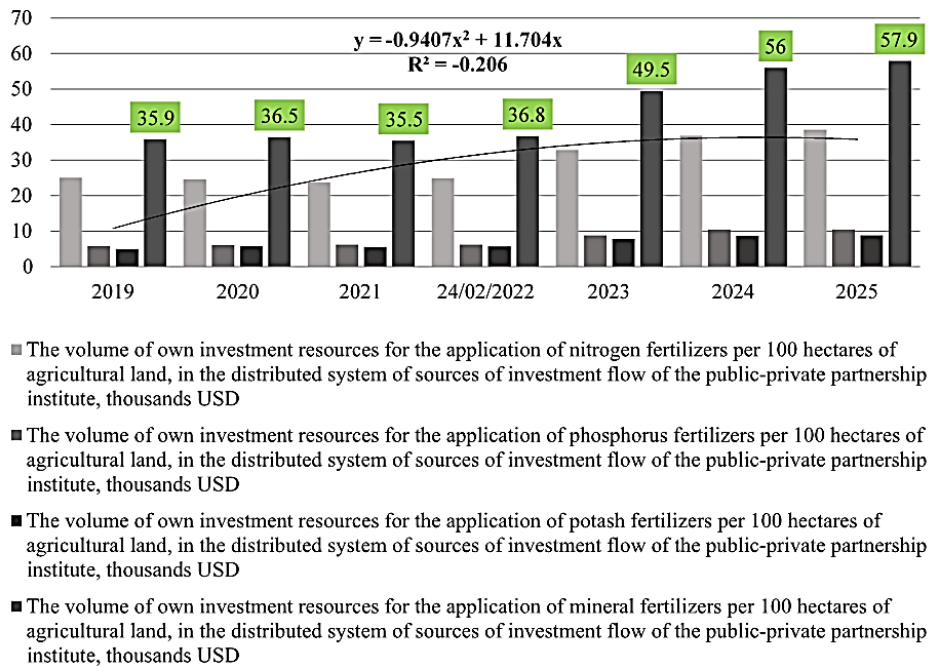
The next important direction of the movement of the own sources of the investment flow of subjects of agro-food production of Ukraine is the restoration of mineral fertilizer reserves. The market of mineral fertilizers, in contrast to the market of seeds, decreased by about 1% in 2021-2022, which is due to numerous factors: a change in the nature of the use of fertilizers in European countries, trade tension on



**Fig. 13:** Positive and negative investment flow from the export and import of seeds of agricultural crops of subjects of agro-food production of Ukraine for 2023-2025, %; Note. PIPexport – is positive investment flow from exports; VIPimport – is a negative investment flow from imports.



**Fig. 14:** Structure of own investments of agro-food production entities of Ukraine for mineral fertilizers in the distributed system of sources of investment flow of the public-private partnership institute, %



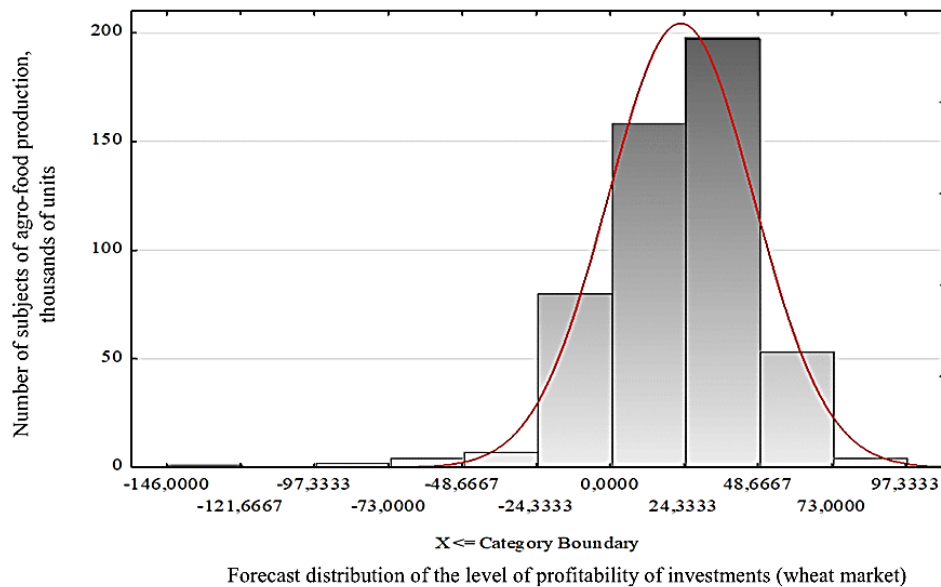
**Fig. 15:** The forecast volume of the needs of subjects of agro-food production of Ukraine for the purchase of mineral fertilizers in the distributed system of sources of investment flow of the institute of public-private partnership, %.

the world market (war and political crisis), currency devaluation (Britchenco et al., 2020). The structural distribution of own investments of agro-food production entities for the purchase of mineral fertilizers and the restoration of agricultural lands of Ukraine in the post-war period requires the financial support of the public-private partnership institute, presented in Fig. 14.

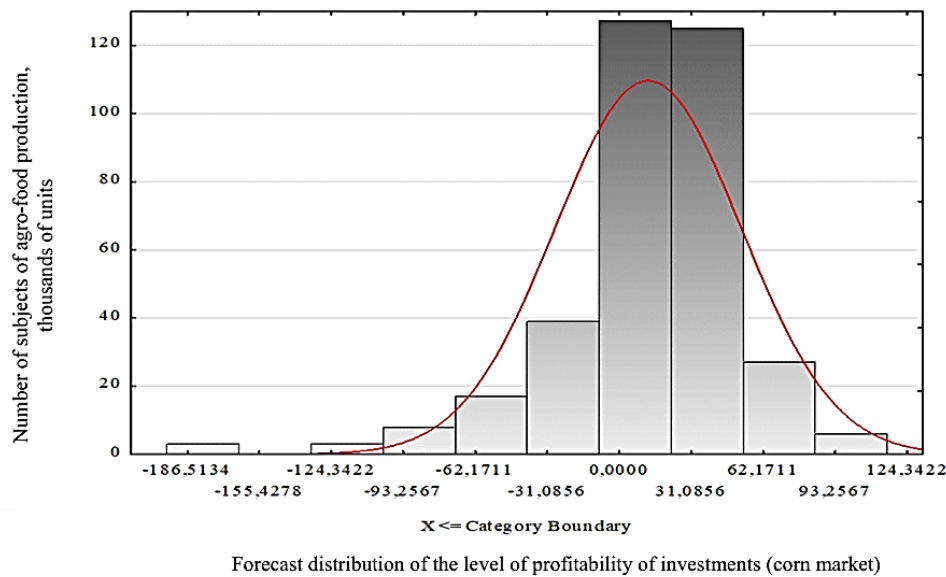
Fig. 15 presents the forecast volume of needs of agro-food production entities of Ukraine for the purchase of

certain types of mineral fertilizers in the distributed system of sources of investment flow of the public-private partnership institute in the period 2023-2025.

Thus, in the forecast period of 2023, subjects of agro-food production, for the application of mineral fertilizers on 100 hectares of agricultural land, need additional financial support from the institute of public-private partnership within 34.5% of the level of 2022. In a distributed system sources of the investment flow of the public-private partnership institute,



**Fig. 16:** Forecast distribution of the level of profitability of investments (wheat market) among subjects of agro-food production of Ukraine, on average for 2023-2025, %.



**Fig. 17:** Forecast distribution of the level of profitability of investments (corn market) among subjects of agro-food production of Ukraine, on average for 2023-2025, %.

financial assistance for nitrogen fertilizers should be 32.1% more than the volume of investment before the beginning of martial law in the country, i.e. on 24.02.2022; for phosphorus fertilizers – by 41.9%, for potash fertilizers – by 36.8% respectively. The annual amount of financial support from the level of 2022 will increase and be distributed according to the types of mineral fertilizers: in 2024, nitrogen fertilizers – by 48.1%, phosphorus fertilizers – by 67.7%, potash fertilizers – by 52.6%; in 2025 – by 55.0%, by 69.4%, by 54.4% respectively. The consumption of basic mineral fertilizers will be carried out at the expense of imports.

The nature of the dynamics of world markets determines the internal investment capabilities of agro-food production entities, their features to compete with each other and determine the most effective investment policy. Therefore, in order to diversify the financial dominant that ensure high investment activity of producers of agro-food products, it is proposed to determine the parameters of restoring their investment attractiveness on the market

based on the level of profitability of investments. Taking into account the specificity of subjects of agro-food production, we calculated the predicted values of the studied indicator, subject to the introduction of own sources of investment flow in individual agricultural crops. Fig. 16 presents the spread of the obtained values of the indicator of profitability of investments by the type of product on the market – wheat. Table 3 presents the parameters of the distribution range.

According to the forecast, more than 80% of the investigated subjects of agro-food production will receive a positive result. The largest group (39.3%) is characterized by the level of profitability of investments in the range from 25% to 49%; group of manufacturers (10.5%) is in the range from 49.8% to 74%, 31.2% of manufacturers is in the range from 0.8% to 25%, which in general indicates a high level of investment attractiveness in the market of this crop.

The share of profitable subjects of agro-food production that activate investment opportunities in the corn market will be 76% (Fig. 17, Table 4).

**Table 3:** Distribution of values of the forecast level of profitability of investments (wheat market) among subjects of agro-food production of Ukraine on average for 2023-2025, %

Ranges	Number of Subjects	Cumulative Amount	Percentage	Cumulative Percentage
$-145.287 \leq x \leq -120.953$	1	1	0.198	0.198
$-120.953 \leq x \leq -96.62$	-	1	0.000	0.198
$-96.62 \leq x \leq -72.287$	3	4	0.395	0.593
$-72.287 \leq x \leq -47.953$	3	6	0.841	1.383
$-47.953 \leq x \leq -23.62$	6	12	1.484	2.777
$-23.62 \leq x \leq 0.714$	81	95	15.813	18.587
$0.714 \leq x \leq 25.047$	160	254	31.235	49.802
$25.047 \leq x \leq 49.38$	199	452	39.343	88.742
$49.38 \leq x \leq 73.713$	49	492	10.544	99.215
$73.713 \leq x \leq 98.0467$	8	510	0.825	100.00

**Table 4:** Distribution of values of the forecast level of profitability of investments (corn market) among subjects of agro-food production of Ukraine on average for 2023-2025, %

Ranges	Number of Subjects	Cumulative Amount	Percentage	Cumulative Percentage
$-195.313 \leq x \leq -164.227$	3	3	0.847	0.845
$-164.227 \leq x \leq -133.142$	-	3	0.000	0.845
$-133.142 \leq x \leq -102.056$	3	6	0.845	1,690
$-102.056 \leq x \leq -70.971$	8	14	2.253	3.944
$-70.971 \leq x \leq -39.885$	17	31	4.789	8.732
$-39.885 \leq x \leq -8.8$	39	70	10.985	19.718
$-8.8 \leq x \leq 22.286$	127	197	35.775	55.493
$22.286 \leq x \leq 53.372$	125	322	35.211	90.704
$53.372 \leq x \leq 84.457$	27	349	7.606	98.301
$84.457 \leq x \leq 115.543$	6	355	1.690	100.000

**Table 5:** Distribution of values of the forecast level of profitability of investments (corn market) among subjects of agro-food production of Ukraine on average for 2023-2025, %

Ranges	Number of Subjects	Cumulative Amount	Percentage	Cumulative Percentage
$-111.289 \leq x \leq -89.291$	1	1	0.215	0.215
$-89.291 \leq x \leq -67.297$	-	1	0.000	0.215
$-67.297 \leq x \leq -45.293$	2	3	0.431	0.647
$-45.293 \leq x \leq -23.294$	6	9	1.293	1.940
$-23.294 \leq x \leq -1.295$	20	29	4.310	6.250
$-1.295 \leq x \leq 20.704$	99	128	21.336	27.596
$20.704 \leq x \leq 42.703$	178	306	38.36	65.953
$42.703 \leq x \leq 64.702$	122	428	26.293	92.241
$64.702 \leq x \leq 86.701$	32	460	6.897	99.147
$86.701 \leq x \leq 108.699$	4	464	0.863	100.00

There are 33% of producers of agro-food products in the range from 0% to 22% of the profitability of investments, 35% of producers have values from 22% to 53%, which also indicates high investment attractiveness in the market.

The forecast of the level of profitability of investments made by subjects of agro-food production in the sunflower market is shown in Fig. 18 and Table 5.

The sunflower market is characterized by one of the highest indicators of the share of profitable enterprises (93%), which makes up the lion's share of the sample volume. A high level of return on investment in the sunflower market from 21% to 43% is characteristic of 38% producers of agro-food products. The range from 43% to 65% included 26% of subjects of agro-food products.

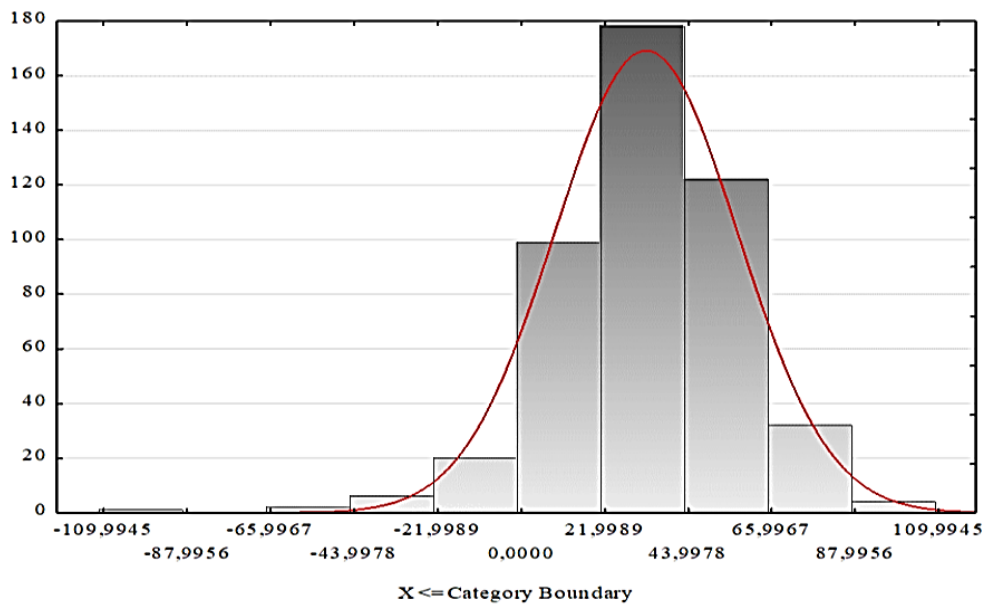
At a certain level of activity of investment opportunities, the grouping of subjects of agro-food production on the market of crop seeds was carried out according to the qualitative criterion of the studied indicator, which takes into account its own sources of investment flow, taking into account the sources of the institute of public-private partnership, which have different parameters between the average values (Fig. 19). Three

sets were obtained, which are statistically significant characteristics between the average levels of the indicator.

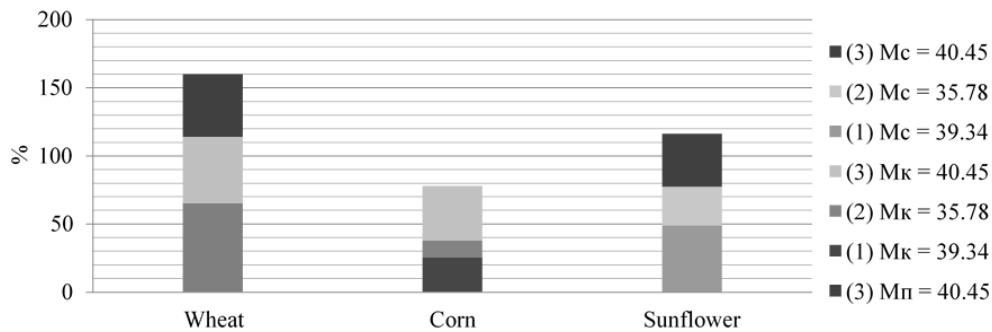
Thus, in 2023-2024, wheat will be included in the first group in terms of the maximum movement of sources of investment flows in the crop seed market. The level of profitability of investments made by subjects of agro-food production will correspond to the average range from 45.8% to 65.4%. The second group includes corn, with an average investment attractiveness. The level of profitability of investments will correspond to the average range – from 12.4% to 40.3%. Sunflower will belong to the third group - the middle range – from 12.4% to 40.3% respectively.

## Conclusions

On the basis of the used mathematical tools, the system of distributed relations of the public-private partnership institute is able to change the financial dominant of the sources of the investment flow for the balanced value of their target use. Restoring and ensuring the activation of investment opportunities of agro-food production entities is



**Fig. 18:** Forecast distribution of the level of profitability of investments (sunflower market) among subjects of agro-food production of Ukraine on average for 2023-2025, %.



**Fig. 19:** Estimated volume of distribution of the average level of profitability of investments of agro-food production entities of Ukraine in the case of the need for seed cultures according to the average parameters of own sources of investment flow, taking into account the flows of the institute of public-private partnership, on average for 2023-2025.

due to the specific features of conducting investment processes, where the investment opportunities of agro-food producers are decisive in the optimal distribution of own and borrowed resources.

Despite the difficulties of implementing financial support for the institute of public-private partnership of Ukraine during the wartime period, the strengthening of budgetary investment in the post-war period will allow the restoration of soft loans for producers of agro-food products, which in the near future will require assistance, subsidization of the crop and livestock industries. A tangible impact on the restoration of the parameters of the internal sources of the investment flow of agro-food production entities will be due to the creation of special funds that offer investors the opportunity to unite capital to expand the investment opportunities of producers. In addition, a thorough assessment of the risks of investment opportunities and the investment platform of agro-food production entities will allow to level the irrational distribution of sources of investment flow according to the geographical location of investment-attractive producers on the market. Diversification of investments and support of each individual subject of a certain agro-food industry will be more productive, from the standpoint of timeliness and control over the targeted use of investments by the public-private partnership institute with the provision of benefits to individual industries.

#### Authors' Contributions

Natalia V. Kukina: Writing - Original Draft, Conceptualization. Yuliia P. Makarenko: Writing - Original Draft, Methodology. Larisa M. Melnyk: Writing - Review & Editing, Data Curation. Yuliia M. Zavaloka: Writing - Original Draft, Software. Maryna V. Sidnenko: Writing - Review & Editing, Supervision. All authors critically revised the manuscript and approved the final version.

We declare any financial and personal relationships with other people or institutions/organizations that could unsuitably affect their research work.

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