Conceptual models of state support for agriculture: From direct producer support to financing general agricultural services

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Abstract. Since the concept of state support for agriculture in Ukraine is not perfect and requires improvement, given the limited financial capabilities of the country during a full-scale invasion and post-war recovery, the aim of the article was to find an optimal model of state support based on the experience of countries with a highly developed agricultural sector. The features of conceptual models of state support were considered through indicators of structural and dynamic analysis and assessments of the effectiveness of budget support in the EU, Canada, New Zealand, the USA, and Ukraine. The premise of the study was an analysis of the overall imbalance level of state support directions for agriculture, according to the results of which none of the countries had a balanced approach to regulating the agricultural sector. It was established that the reason for the highest levels of imbalance in the EU was the undisputed dominance of producer support and, in the USA – consumer support, simultaneously with a low priority of financing for agricultural knowledge and innovations in both countries. A hybrid model of state support turned out to be a feature for Ukraine since dissimilar directions prevailed during different periods of turbulence. Given the assessment of the effectiveness, Ukraine should use the Canadian model in the short term, which, although similar to the EU, supports farmers on a much smaller scale and has a relatively upper focus on general services for the agriculture, in particular inspections and controls and knowledge and innovations. It was established that in the long term, the priority is to adapt the New Zealand approach with the absolute dominance of investments in infrastructure, research and technological development, which ensures maximum economic effect and competitiveness of the industry. The findings of the study can be used by the Ukrainian authorities, in particular the Ministry of Agrarian Policy and Food, to improve state support programmes for agriculture by adapting effective financing models based on international experience and taking into account the economic and resource realities of the country

Keywords: agricultural sector; Ukraine; imbalance level of state support; efficiency; value of agricultural products; agricultural knowledge and innovation; New Zealand

INTRODUCTION

Since each country has specific natural and climatic, economic conditions and financial capabilities, which affect the determination of state agrarian policy priorities, the structure, directions, and types of agricultural support have significant differences. Since Ukraine needs to implement a well-founded and consistent concept of state intervention in the development of the strategically major agricultural sector, deepening research into the

balance of state support, its effectiveness, and its impact on agricultural production is a component of ensuring its long-term prosperity, which is especially important for the post-war recovery of Ukraine. The agricultural sector of Ukraine plays a critical role in shaping economic security and ensuring balanced development, being one of the strategically important sectors of the national economy. However, the criticality of the challenges that agricultural producers have faced daily over the past decades has steadily increased during the period of martial law.

L. Vdovenko (2022), studying the instruments of state financial support under martial law and the problems that faced Ukrainian agriculture, emphasised their negative impact on the development of the industry. In the author's opinion, the concept of state support was not ideal, as it required a change in the vector of agricultural policy due to the aggravation of the issue of food security not only at the national but also at the global level. Economist Impact (2023) data reinforced this conclusion since there was a decrease in the food security level in Ukraine in 2022. The country lost 13 positions and took 71st place out of 113 assessed countries, compared to 58th in 2021. R.V. Ivanov *et al.* (2024) also emphasised the importance of supplementing state support mechanisms, analysing the exporters' behaviour in the case of a disruption of one of the chief logistical supply chains under martial law.

Russian military aggression, the consequences of which are damage to granaries, greenhouses, farms, and machinery, rising prices and a decrease in production and income due to logistics disrupted by the war, and the destruction of irrigation and port infrastructure, became the most significant problem and threat to agricultural activity, as was emphasised in the study by H. Cherevko (2022). Its negative impact on agriculture should be levelled or mitigated by implementing a complex of budgetary, price, tax, scientific, credit, and foreign economic instruments implemented within the framework of state agrarian policy. However, S. Kolotukha *et al.* (2019) noted that the wrong priorities of state agricultural policy are one of the factors causing the decline in agricultural production. Even though the authors' study was aimed at identifying key problems in the financial provision of farming enterprises, the principal attention was still focused on analysing the growth of agro-industrial production and the loans provided to it. Although lending to agricultural producers is a means of influencing the crisis in the sector, applying only this support measure without alternative approaches that demonstrate effectiveness based on international experience narrows the possible ways of reforming the support model. Thereby, state support measures must be justified and contribute to the

maximum achievement of the planned results to ensure rational agricultural sector regulation. Despite the importance of state support, the existing agro-protective mechanisms of state support in Ukrainian legislation, according to K. Hryhorieva (2024), were rather declarative. Although the author analysed the essence of state support types for agriculture through the prism of the evolutionary development of the regulatory framework, the study results insisted on the need for conceptual reform of agro-protective measures, which have become urgent since 2022.

D. Shelenko *et al.* (2023), when justifying the concept of state support for the development of agricultural producers, concluded that it should include a set of targeted measures that would contribute to agricultural production development and encourage the introduction of intensive technologies. For these reasons, the current model of state support requires adjustment and improvement, which is especially important in the context of rapid changes in systemic security challenges. V. Lavruk & N. Pokotylska (2019) proposed a conceptual model of the strategy of state financial support for livestock enterprises in Ukraine, which was an essential step given its permanent stagnation and lower development rates compared to crop production. However, given the weak diversification of plant production, which consists of the dominance of grain crops, it is substantial to develop models of effective state regulation of the agricultural sector in general.

The focus of the study by M. Gumeniuk & D. Nemish (2024) was to assess the main organisational and economic problems of the agricultural sector development during martial law and post-war reconstruction in Ukraine. Analysing the strategic directions of state support for small producers, the authors also focused on the importance of its increase to overcome the crisis phenomena faced by small farms. Despite the probable inability of small producers to solve problems independently without state intervention, the study did not sufficiently reveal the effectiveness of existing state support measures, especially in conditions of strict budget constraints that will persist in the post-war reconstruction period. Based on this, proposing a sound policy for small business development, a comparative analysis of Ukraine with countries whose agricultural sector demonstrates high productivity without excessive support, New Zealand in particular, would be of additional value.

According to I. Dinis (2023), agricultural policy was becoming particularly meaningful for the Ukrainian government due to the increase in expenditures on supporting producers by UAH 4 billion in 2025 compared to the previous one. In the article, the authors studied the effectiveness of state support, in particular

subsidies, loans, and tax breaks, in ensuring the development of agricultural enterprises in Ukraine and increasing their competitiveness. Comparing forms of state support with the experience of Canada, it was determined that Ukraine should carefully analyse successful approaches to the financial resources distribution of other countries to adopt them and innovatively solve problems. However, despite the Canadian case used, the analysis of the state support model in Ukraine and the level of its balance compared to other conceptually different models operating in countries with highly developed agriculture (for example, in the EU, the USA, or New Zealand) remained insufficiently disclosed, which limits the formulation of balanced recommendations for Ukraine.

T.O. Kharchenko (2022) studied the structure of state financial and economic support for the agricultural sector of Ukraine, comparing it with a set of countries around the world based on generalised statistical indicators developed by the Organization for Economic Co-operation and Development (OECD), namely the Total Support Estimate (*TSE*), Producer Support Estimate (*PSE*), Consumer Support Estimate (*CSE*), General Services Support Estimate (*GSSE*). Even though it enabled shaping the view of the state support level and its dynamics, the study did not focus on distinguishing its conceptual features (orientation on producers, consumers, or general services for the agricultural sector) and the

effectiveness of each state support model. It, in turn, limits the possibilities of forming recommendations on the optimal vector of transformation of the state support system, which would ensure the agricultural sector development of Ukraine in the short and long term.

Since the concepts of state support followed abroad have not been given due attention, an interstate comparison of support features for the agricultural sector, considering its effectiveness under each conceptual model, remained relevant. For these reasons, the purpose of the study was to identify conceptual models of state support for agriculture and analyse their impact on the effectiveness of agricultural production in Ukraine, the EU, New Zealand, Canada, and the USA, as well as to identify promising areas of state intervention that can be adapted by Ukraine in the short and long term in conditions of limited financial capabilities.

MATERIALS AND METHODS

The features of state total support for agriculture (*TSE*) in the EU, Ukraine, New Zealand, Canada and the USA were considered by analysing its individual directions. To determine the dominant types of state support (x_{ij}), which had the largest share in country *j* among the *i*-th number of types ($i = \overline{1.14}$), presented in Table 1, samples were formed according to data from the Organisation for Economic Co-operation and Development (OECD, 2023) in 2010-2022.

Table 1. *Types of state support (x_i) in the structure of total support directions (TSE) of the agricultural sector in country j*

Variable	Types	The essence of state support measures within the type
Producer Support Estimate (*PSE$_j$*)		
x_{1j}	Support based on commodity output	A set of measures that create a gap between domestic market prices and marginal prices for a given agricultural product or are based on its current production
x_{2j}	Payments based on input use	Payments provided to reduce the cost of variable inputs; investment costs in buildings, equipment, plantations, drainage, soil quality; costs of technical, accounting, phytosanitary and other services
x_{3j}	Payments based on current area planted / animal numbers / receipts / income, production required	Payments provided per hectare of crops or livestock, income tax benefits
x_{4j}	Payments based on non-current area planted / animal numbers / receipts / income, production required	Payments provided for the average level of production over a certain period, for a set number of farm animals
x_{5j}	Payments based on non-current area planted / animal numbers / receipts / income, production not required	Subsidies for historical crop area without mandatory cultivation, fixed number of farm animals
x_{6j}	Payments based on non-commodity criteria	Payments related to environmental or social initiatives, specific non-commodity products, one-off payments to all farmers
x_{7j}	Miscellaneous payments	Payments for which there is insufficient information to classify them in the above categories
General Services Support Estimate (*GSSE$_j$*)		
x_{8j}	Agricultural knowledge and innovation system	Financing of research and development, knowledge transfer through agricultural education, training, advisory and consultancy services to farmers
x_{9j}	Inspection and control	Financing of inspections of domestic products, border inspections, control of pests and diseases in crop or livestock production, state expenditures on veterinary and phytosanitary services

Table 1, Continued

Variable	Types	The essence of state support measures within the type
x_{10j}	Development and maintenance of infrastructure	State investments in irrigation and drainage networks, storage facilities, port facilities (docks, elevators), wholesale markets, land cadastres, seed registers
x_{11j}	Marketing and promotion	Financing of promotion of agricultural products (advertising campaigns, participation in international fairs)
x_{12j}	Cost of public stockholding	Covering costs associated with state reservation of agricultural products
x_{13j}	Other miscellaneous general support payments	Financing of services for which information is insufficient to classify them in the above categories
	Consumer Support Estimate (CSE_j)	
x_{14j}	Consumer support	Supporting consumers by lowering prices for agricultural products through subsidies or domestic food aid programs

Notes: *the volumes of state support were measured in millions of US dollars*
Source: *OECD (2023)*

The prerequisite for studying conceptual models of state support for agriculture in the above-mentioned countries was the assessment of the balance of its components. For this purpose, the formed pairs (*PSE/GSSE*, *CSE/GSSE*, *CSE/PSE*) were used, which fully characterised the uniformity of the distribution. Since the ideal balance was the equality of the proposed ratio to 1, the imbalance level of state support directions in country was determined using the Euclidean distance (D_j) from the reference point (*1,1,1*) in three-dimensional space:

$$D_j = \sqrt{\left(\frac{PSE_j}{GSSE_j} - 1\right)^2 + \left(\frac{|CSE_j|}{GSSE_j} - 1\right)^2 + \left(\frac{|CSE_j|}{PSE_j} - 1\right)^2}. \quad (1)$$

In order to take into account the negative impact of *CSE* on consumer prices and incomes, which could not be ignored, for the EU, New Zealand, Ukraine, and Canada its values were absolute, since using the value without a modulus would lead to a distorted picture with the illusion of the absence of consumer subsidies, even when the state carried out significant interventions. Based on the obtained values, the directions of state support were balanced if $D_j = 0$. In cases where $D_j > 1$, the model of the studied country fell into the zone of significant imbalance with a focus on one direction at the expense of others. Since the group assessment of the overall imbalance level of state support directions only showed how far the country has deviated from the balance, a number of criteria were used for an in-depth analysis of state support models, grouped into two substantive categories. The first included indicators of the structural and dynamic analysis of *TSE*, which allowed for assessing the dominant directions and types of state support in each of the countries and their change in 2017-2022 compared to 2011-2016. The corresponding prevalence

rates (KP_j), constructed and interpreted according to the same scheme, were used to determine the main reason for state support imbalance (priority of support for producers, consumers, or general services). In particular, the prevalence of direct support over consumer support and financing of general measures for the agricultural sector ($KP_{j(PSE)}$) was determined by the formula:

$$KP_{j(PSE)} = \frac{PSE_j}{(|CSE_j| + GSSE_j)}, \quad (2)$$

where CSE_j – estimated consumer support by module to neutralise absorption of its negative impact by the direction *GSSE*. Since, in this case, the ratio of each direction of support (*PSE*, *GSSE*, *CSE*) to the sum of the other two was considered, and each of the three components occupied the same share, the threshold value of dominance was $1/2$. Thus, if $KP_j > 1/2$, then the specified direction prevailed over the other two. Otherwise, the components considered did not play a key role in the state support model. The elasticity of direct producer support ($E_{(PSE/TSE)}$) concerning to total support in country j showed how much direct support increased in 2017-2022 compared to 2011-2016 in response to the growth of *TSE* and is determined by the formula:

$$E_{j(PSE/TSE)} = \frac{\%\Delta PSE}{\%\Delta TSE}. \quad (3)$$

If both indicators showed negative growth (EU, Ukraine, Canada), then if $E_{(PSE/TSE)} > 1$ – *PSE* showed a faster rate of decline than *TSE*; $0 < E_{(PSE/TSE)} < 1$ – *PSE* was declining more slowly than *TSE*. If both indicators showed positive growth (New Zealand, USA), then $E_{(PSE/TSE)} > 1$ meant that the support policy was becoming more farmer-centric in 2017-2022; at $0 < E_{(PSE/TSE)} < 1$, *PSE* growth occurred at a slower rate, which indicated a shift in the priority of direct support for farmers towards other directions of support.

In addition, the criteria that demonstrated the conceptual differences of the models included the average share of *PSE* in the structure of gross farm receipts (GFR) and its shift in 2017-2022 compared to 2011-2016, the average share of financing for agricultural knowledge and innovation (x_8) over the entire period under study (2010-2022) and the top 5 dominant types of state support (x_{ij}) over the past five years. It facilitated the assessment of the dependence of farmers' incomes on state support and the level on which the country relied, developing the agricultural sector through knowledge, technology, and innovative approaches. To clearly present them, visualisation of the evolution of direct state support shares in the structure of gross farm receipts and the structure of general support for the agricultural sector with an emphasis on financing for agricultural knowledge and innovation was used.

The second category included indicators of the preliminary assessment of total budget support (*TBSE*), which allowed for the determination and comparison of the effectiveness of each of the models. Unlike *TSE*, *TBSE* reflected purely budgetary expenditure aimed at supporting the agricultural sector. The starting point, which showed the current efficiency level in absolute terms, was the rate of budget support return (*RTBSE*) in country *j*. It gave an idea of how much agricultural output (*ValueAP$_j$*) was generated for each unit of state budget support (*TBSE$_j$*) on average in 2010-2022 and was determined by the formula:

$$RTBSE_j = \frac{ValueAP_j}{TBSE_j}. \tag{4}$$

In addition to the rate of budget support return, to understand its trend, the change rate of *RTBSE$_j$* was determined – the growth rate (α_{1j}) in the univariate regression model using time *t* as the independent variable. If $\alpha_{1j} > 0$, then the return from budget support *RTBSE$_j$* demonstrated gradual growth, however, extreme values indicated sharp changes in state agricultural policy and transformation of the state support model. The final indicator that made it possible to summarise the flexibility of the relationship between the level of budget support and the result was the elasticity of agricultural product value ($E_{j(VAP/TBSE)}$), which showed how much the change in budget financing (%$\Delta TBSE_j$) in 2017-2022 compared to 2011-2016 stimulated the change in the resulting variable (%$\Delta ValueAP_j$). If $E_{j(VAP/TBSE)} > 1$, an increase in budget support led to a faster growth in the value of agricultural products, which meant high efficiency and a multiplier effect. If $E_{j(VAP/TBSE)} < 1$, the state's financial resources were used less efficiently, and the elasticity value < 0 was a sign of structural problems in the agricultural sector, and the value of the products inversely depended on state intervention measures. The proposed comprehensive assessment allowed for narrowing the search space for optimal models of state support for Ukraine, focusing only on relevant concepts, the adaptation of which will bring the most effective and stable results in the short and long term.

RESULTS AND DISCUSSION

According to the OECD (2023) methodology, one of the state support directions for agriculture is the Producer Support Estimate (*PSE*), which reflects the annual monetary value of gross transfers and is provided by governments directly to agricultural producers, generally in the form of subsidies or partial reimbursement, maintaining the stability of farmers' incomes. In turn, the General Services Support Estimate (*GSSE*) characterises those forms of state intervention that provide broad benefits to the farming sector through infrastructure development, financing for research and development, education, inspections, or control. It means that the amount of state funding in this area does not directly change either revenues or expenditure at the level of individual agricultural agents. Consumer Support Estimate (*CSE*) is the third direction of state support, within which domestic food aid programs are implemented for consumer nutrition in cash or product forms. The total annual monetary value of all gross transfers by the directions (*PSE*, *GSSE*, and *CSE*) is embodied in the estimated total support (*TSE*) indicator. It regards not only actual budget expenditures reflected in the government accounts but also indirect hidden measures, such as market price support or tax benefits (foregone state budget revenue).

In the EU, Ukraine, New Zealand, Canada, and the USA, state support for agriculture had significant differences, which primarily consisted of the priority of its various directions and the stability of the state agricultural policy strategy. Considering the analysis of the Euclidean distance, which allowed for estimating the deviation of direct support for producers (*PSE*), general support for the agricultural sector (*GSSE*), and consumer support (*CSE*) from the reference point with coordinates (*1,1,1*) in three-dimensional space, none of the studied countries had a balanced approach to regulating the agricultural sector (Fig. 1). Instead, depending on economic conditions, political decisions and priorities, the mentioned countries demonstrated different models of state support for agriculture with the dominance of some directions over others.
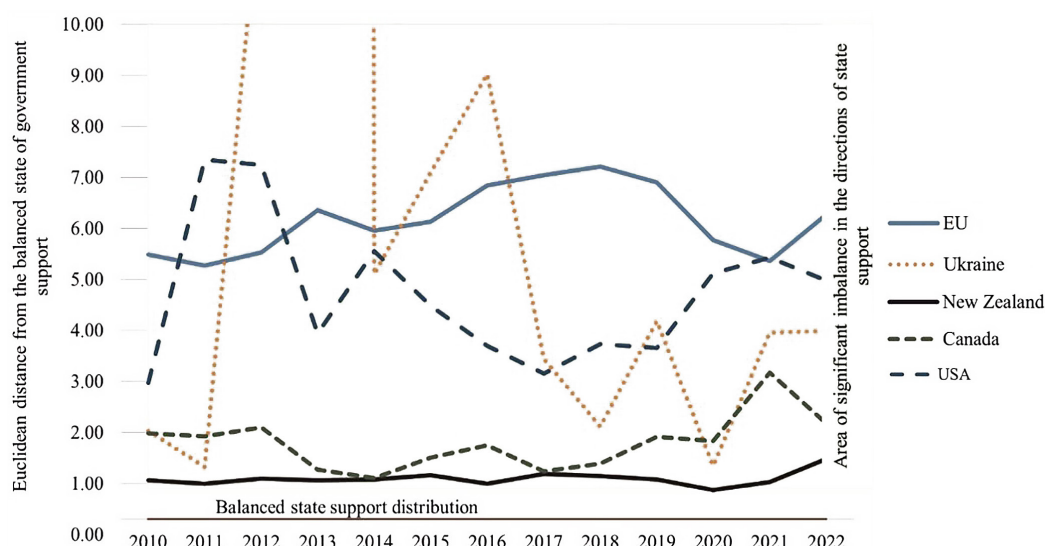
Figure 1. *Imbalance of state support to agriculture in 2010-2022: contrast of the EU compared to New Zealand*
Notes: *Euclidean distance values for Ukraine in 2012 (12.85) and 2013 (500.68) were not shown in the graph to maintain a comparable scale*
Source: *constructed by the author according to OECD (2023) data*

The EU was characterised by the relatively highest overall level of imbalance in 2017-2022 ($D = 6.43$). The relative decrease in imbalance in 2020-2021 was due to the increase in *GSSE* volumes compared to *PSE* during the active phase of the pandemic, especially in the agricultural knowledge and innovation system (x_8), as well as infrastructure development (x_{10}), compared to the pre-pandemic period of 2016-2019. Stable ratios of other components indicated the unchanged orientation of their policy of active subsidies and direct support for farmers, although its volumes decreased by 1.03% annually during 2010-2022. Analysis of the prevailing direction gave grounds to argue about the absolute dominance of direct support since $KP_{PSE} = 3.31 > KP_{CSE} > KP_{GSSE}$ in 2017-2022.

The USA, like the EU, was characterised by a significant level of imbalance ($D = 4.34$) in the corresponding period, which was especially growing in 2011-2012 and 2020-2022. Its reason was a sharp jump in *CSE* compared to *GSSE* in order to strengthen state food assistance to consumers in times of crisis and the secondary nature of the overall development of the agricultural sector. Although their state support model was characterised by high flexibility with moderate direct support for producers ($KP_{PSE} = 0.64$), according to the analysis, the dominant direction was consumer support ($KP_{CSE} = 1.01$), which allowed for smoothing market fluctuations and guaranteeing food security for citizens. For these reasons, *CSE* was characterised by the highest average annual growth rate, which was 7.01%, the

volumes of which increased from 32,982.19 million US dollars in 2010 to 74,400.12 million US dollars in 2022, significantly exceeding annual growth in other directions – *PSE* (+3.07%), *GGSE* (+2.62%).

According to the criterion of imbalance of state support for agriculture in 2017-2022, Ukraine was next after the EU and the USA ($D = 3.17$). Its characteristic feature was the lack of a stable strategy due to the influence of external factors related to military aggression, both economic and political upheavals. Extreme values of deviations from the balance in 2012-2013 were associated with a sharp drop in *PSE* against the background of record volumes of *GSSE* (774.79 million US dollars in 2012) and *CSE* (1,342.18 million US dollars in 2013). During the crisis periods of the hybrid war (2014-2022) and the full-scale Russian invasion starting in 2022, accompanied by a decline in state support, the main priority for the government remained to ensure the ability of consumers to purchase goods (at lower prices compared to those offered in a completely competitive sector).

Based on the analysis of the prevailing trends, a reliable conclusion was that Ukraine is characterised by a hybrid model of agricultural support since KP_{PSE} (0.79) $\approx KP_{CSE}$ (0.75). In various turbulent periods, direct producer (2010-2011, 2018-2020) and consumer support (2012-2017, 2021-2022) dominated in Ukraine against the background of a small level of financing of general services for the agricultural sector (in 2010-2022 $KP_{GSSE} = 0.29 < 0.5$), the volumes of which decreased annually by 6.85% in the studied period.

An equally significant reason for the volatility of the KP_{PSE} ratios was the sharp fluctuations of one of its components – market price support (MPS), which, according to descriptive statistics, had a variation range of 3,808.25 million US dollars: from (-3,124.31) million US dollars in 2011 to 683.94 million US dollars in 2019. The peak of KP_{PSE} in 2018-2020 was associated precisely with the positive effect of this type of direct producer support because only in the specified period did Ukrainian farmers sell products to the foreign market at prices that were 0.05-2.00% higher than the world ones. It indicated the protection of Ukrainian producers by the state's foreign trade policy, which was insufficient in 2010-2017 and 2021-2022. Compared to other studied countries, whose national producers were constantly protected from foreign competition and sold products in 2010-2022 at prices higher than the world average, only in Ukraine did the state support of market prices (through taxes, export restrictions, or prices for agricultural products on the domestic market to protect consumers and other regulatory actions) have a predominantly negative effect and, as a result, led to a decrease in the income of Ukrainian farmers.

For the Canadian model of state support, the imbalance level was moderate compared to the EU, the US, and Ukraine ($D = 1.95$). Apart from the peak in 2021, triggered by a sharp increase in *PSE* compared to *GSSE* in response to the COVID-19 pandemic, Canada demonstrated consistency in the priority of state support directions, as its ratios were among the most stable. An analysis of the dominant directions gave grounds to argue about the absolute dominance of direct support ($KP_{PSE} = 1.15$), although on a slightly smaller scale than in the EU, with a negligible level of support for the general development of the agricultural sector ($KP_{GSSE} = 0.24$) and state intervention in consumer support ($KP_{CSE} = 0.39$). In addition, the annual growth rates of *PSE* and *GSSE* were negative in 2010-2022, amounting to (-1.38%) and (-2.09%), respectively.

Unlike Canada, the growth rate of general services expenditure (*GSSE*) for the agricultural sector in New Zealand was positive and amounted to 1.14%. According to the balance criterion, the ratio of different of state support directions in the New Zealand model was closest to the reference point of the Euclidean space ($D = 1.13$). The absence of sharp fluctuations indicated the invariance of its conceptual model, which consisted of a low level of both *PSE* and *CSE*, focusing only on general services to the agricultural sector ($KP_{GSSE} = 2.32$). In addition, in 2022, New Zealand further reduced direct state support by 59.53%: from 172.22 million US dollars in 2021 to 69.69 million US dollars with a simultaneous reduction in state intervention in the

formation of consumer market demand. By prioritising funding for agricultural knowledge and innovation (x_8), product inspection and control (x_9), and infrastructure development and maintenance (x_{10}), New Zealand is implementing a model of state support that ensures sustainability, low market distortions, and producer self-sufficiency. Minimising direct producer support, the experience of institutional support for the agricultural sector by New Zealand can serve as a guideline for reforming the strategy of Ukraine's agricultural policy, which is becoming especially relevant in conditions of limited budgetary resources.

An equally significant criterion was the dependence degree of producers' incomes on state support and the level of autonomy, which were calculated to deepen the research of conceptual models of state support for agriculture in the studied countries. The share of direct state support in gross farm receipts in the EU, although it showed a downward trend, which might be associated with the reform of the Common Agricultural Policy (CAP), nevertheless remained significant: from 19.34% in 2010 to 15.10% in 2022 (Fig. 2). Analysis of direct producer support structure indicated that one of the elements of ensuring the stability of the agricultural sector's income in the EU was payments based on both current (x_3) and non-current (x_5) area planted and the number of animals, since their share in the *TSE* structure was over 57.02% in 2017-2022. However, the assessment of shifts showed that while the share of payments by type x_3 increased by 5.69 pp in 2022 compared to 2010, the share of x_5 showed a decrease of 7.33 pp, which was the maximum in the structure. Other components, although relatively smaller, provided an average of 6.33% of farmers' income in 2010-2022.

Thus, the top 5 dominant types of state support for the agricultural sector by their average share in the *TSE* structure in 2017-2022 in the EU were payments based on non-current area planted, number of animals, receipts, income that does not require production (x_5) – 36.90%, payments based on current area planted, number of animals, receipts, income that requires production (x_3) – 20.13%, support based on commodity output (x_1) – 15.78%, payments based on input use (x_2) – 13.52%, agricultural knowledge and innovation system (x_8) – 6.37%. While the share of state support in the structure of producers' incomes was decreasing, and the value of agricultural products was increasing in 2020-2022, the dependent variable is assumed to be more influenced by market or external factors (COVID-19 pandemic, rising world food prices, or war in Ukraine) than by direct state support.

In contrast to the EU model, New Zealand had seen a consistently low share of direct state support in

the structure of farmers' incomes in 2010-2022: from 0.63% in 2010 to 0.32% in 2022 (Fig. 3). It is due to radical reforms implemented almost 40 years ago that were aimed at minimising farmers' dependence on state funding and reorienting the agricultural sector to function depending on market conditions. The decline in the share of producer payments in the structure of gross farmer receipts from 19.36% in 1986 to less than 1% in 2010-2022 was accompanied by a significant increase in the value of agricultural products (+563.85%): from 3,304.93 million US dollars in 1986 to 21,939.70 million US dollars in 2022.
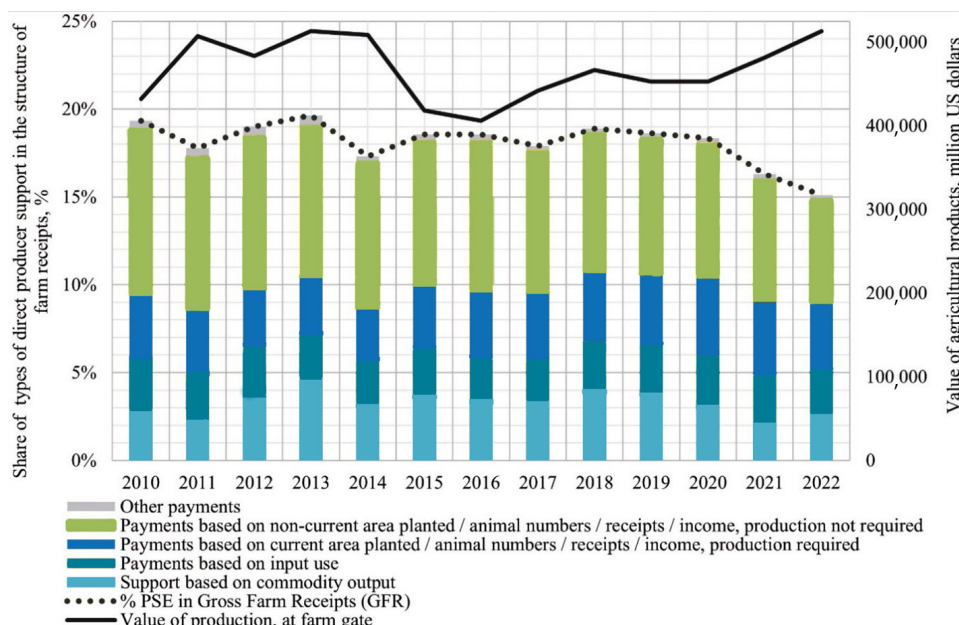
Figure 2. *The share of direct state support in the structure of gross farm receipts in the EU and the value of agricultural products in 2010-2022*
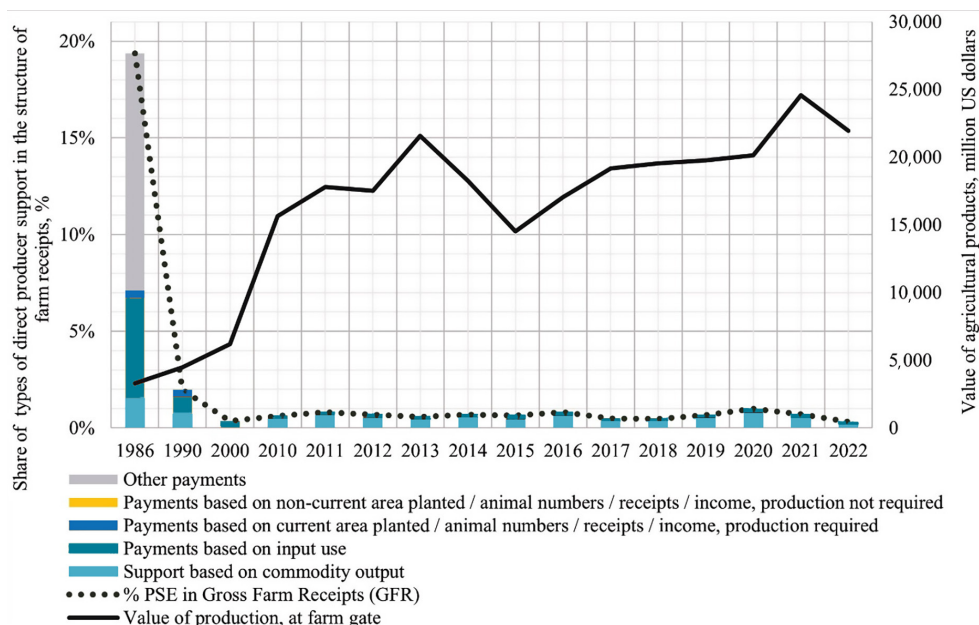***Source:*** *constructed by the author according to OECD (2023) data*

Figure 3. *The share of direct state support in the structure of gross farm receipts in New Zealand and the value of agricultural products in 2010-2022*
Notes: *the dynamic series was expanded to demonstrate the radical changes in the model of state support in 1986-2010*
Source: *constructed by the author according to OECD (2023) data*

Analysis of structural shifts in 2010-2022 indicated that despite the dominance of producer support through protectionist measures (x_1) in the structure of direct support (*PSE*), its share decreased by 10.41 pp, which was not accompanied by a simultaneous decrease in the value of products, that is, New Zealand producers were self-sufficient and competitive at the global level without active state intervention. Thanks to adaptation to market conditions and the use of effective business models, which had required more than one or several years, the New Zealand agricultural sector is thriving due to the growth of its competitiveness, which does not depend on state support volumes. It proved that a sharp reduction in subsidies and direct payments to farmers did not lead to a regression in agriculture development. So, the top 5 dominant types of state support to the agricultural sector by their average share in the *TSE* structure in New Zealand in 2017-2022 were agricultural knowledge and innovation system (x_8) – 34.40%, inspection and control (x_9) – 34.40%, support based on commodity output (x_1) – 17.33%, development and maintenance of infrastructure (x_{10}) – 6.79%, payments based on input use (x_2) – 4.86%.

Analysis of the share of direct payments in the structure of agricultural producers' receipts in Ukraine in 2010-2022 (Fig. 4) indicated the hybrid nature of its state support model: in 2010-2013, it was close to the traditional model of the EU and Canada, demonstrating an average relatively high value (5.48%). However, Russian intervention and full-scale invasion caused its chaotic and forced transition to a certain extent to New Zealand's model, with a share on average less than 1% in 2017-2022.
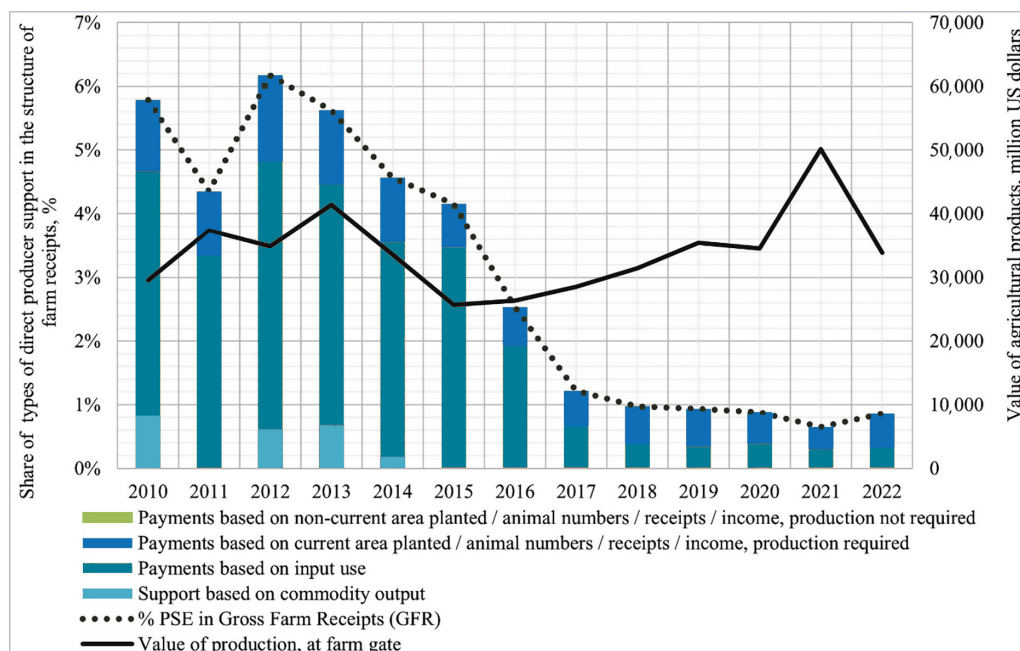

Figure 4. *The share of direct state support in the structure of gross farm receipts in Ukraine and the value of agricultural products in 2010-2022*
Notes: *support based on commodity output (x_1) was presented without taking into account the impact of market price support (MPS) since its negative values make it impossible to correctly calculate the specific weight of types of state support in the structure*
Source: *constructed by the author according to OECD (2023)*

In 2010-2022, the state support model showed changes, but the share of payments based on input resources (x_2) decreased the most (by 29.66 pp). At the same time, similar to the EU and Canada, the share of payments provided per hectare of crops or livestock (x_3) increased in Ukraine by 18.39 pp, which gave grounds to argue about common trends in the state support models of these three countries. Thus, the top 5 dominant types of state support for the agricultural sector by their average share in the *TBSE* structure in Ukraine in 2017-2022 were payments based on current area planted, number of animals, receipts, income requiring production (x_3) – 33.75%, payments based on input use (x_2) – 25.59%, inspection and control (x_3) – 24.25%, agricultural knowledge and innovations (x_8) – 13.46%, support based on commodity output (x_1) – 17.33%, other miscellaneous general support payments (x_{13}) – 1.45%.

The share of direct state support in the structure of gross receipts of Canadian farms was closest to the EU, amounting to 13.76% in 2010-2012 (Fig. 5). The relatively high level of subsidies and payments decreased sharply to about 8-10% starting from 2013, probably due to the implementation of the new agricultural and agri-food policy Growing Forward 2 (Gulab & Lhermie, 2025). Analysis of the direct support structure showed that over 61% in 2017-2022 in the structure of *TSE* fell on payments based on commodity output (x_1) and payments based on current area planted, number of animals, receipts, income requiring production (x_3).
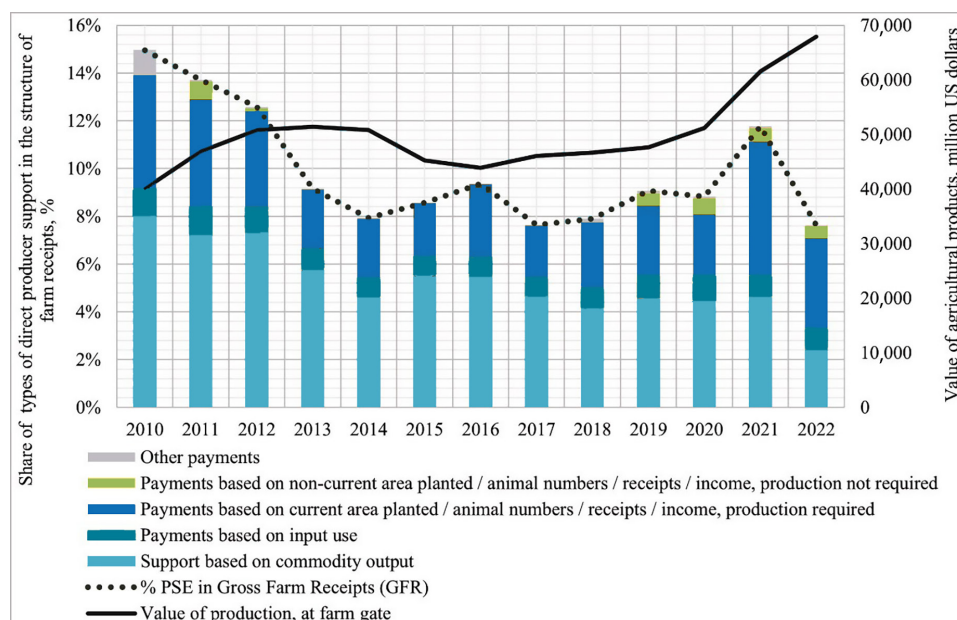

Figure 5. *The share of direct state support in the structure of gross farm receipts in Canada and the value of agricultural products in 2010-2022*
Source: *constructed by the author according to OECD (2023) data*

However, the analysis of structural shifts in 2010-2022 detailed their multidirectional dynamics: while the share of x_3 increased by a record 13.88 pp (similar to the EU and Ukraine), the share of x_1 decreased by 15.72 pp, the structural shifts of which were common with the New Zealand model. This reduction in support for protectionist measures for agricultural producers within the framework of the MPS did not lead to a sharp decrease in the value of products, and the nominal producer protection coefficient (NPC) retained its consistently high value compared to the studied countries, indicating that Canadian farmers sold competitive products at prices that were on average 5-6% more expensive than the world average in 2010-2022. Thus, the top 5 dominant types of state support for the agricultural sector by their average share in the *TSE* structure in Canada in 2017-2022 were support based on commodity output (x_1) – 34.07%, payments based on current area planted, number of animals, receipts, income requiring production (x_3) – 27.15%, inspection and control (x_9) – 11.34%, agricultural knowledge and innovation system (x_8) – 9.91%, payments based on input use (x_2) – 7.88%.

Compared to Canada, the share of direct support in the structure of farmers' receipts in the USA was somewhat smaller and ranged from 7% to 9% (Fig. 6). Its highest values, observed in 2018-2021, were the result of state compensation to farmers affected by the Trump administration's trade disputes with China, Canada, Mexico, and the EU, after which a new special program for compensation of losses related to COVID-19 began (Belasco & Smith, 2022). Despite this, compared to the level of direct producer support in the EU, there was still enough space for market mechanisms to function. Analysis of structural shifts in 2010-2022 showed an increase in the share of payments based on current area, number of animals, receipts, and income requiring production (x_3) by 9.00 pp, which was about 16.60% in the *TSE* structure in 2017-2022. At the same time, the share of state support type x_1 decreased by 6.48 pp, providing only 0.45% of gross receipts of American farms in 2022. Among other direct support measures, no less important was the financing of payments based on the input use (x_2), which accounted for almost a tenth of all total support (*TSE*).
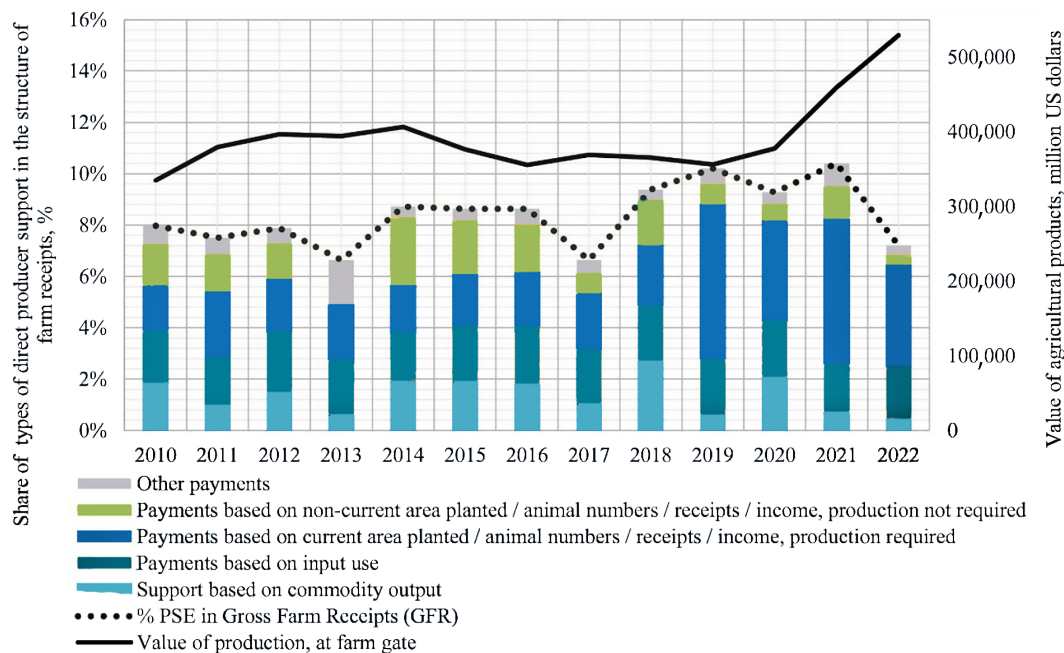
Figure 6. *The share of direct state support in the structure of gross farm receipts in the USA and the value of agricultural products in 2010-2022*
Source: *constructed by the author according to OECD (2023)*

Thus, the top 5 dominant types of state support for the agricultural sector by their average share in the *TSE* structure in the USA in 2017-2022 were consumer support (x_{14}) – 47.44%, payments based on current area planted, number of animals, receipts, income requiring production (x_3) – 16.60%, payments based on input use (x_2) – 8.84%, support based on commodity output (x_1) – 5.37%, payments based on non-current area planted, number of animals, receipts, income requiring production (x_5) – 3.94%.

An additional difference in the state support models of the EU and New Zealand was the variation in the financing of the agricultural knowledge and innovation

(x_8). In the EU, despite the decrease in total support (*TSE*) on average from 118,447.07 million US dollars in 2011-2016 to 109,022.56 million US dollars in 2017-2022, the share of support for research and development, agricultural education, training and extension, on the contrary, increased from 5.72% to 6.37% in the same periods (Fig. 7). Although the volume of direct producer support dominated in the structure, accounting for almost 87.64% over the last five years, the agricultural knowledge and innovation system is most likely to play an important role in determining the development of the EU agricultural sector, even with a relatively small share, which had a linear growth trend from 2010 to 2022.
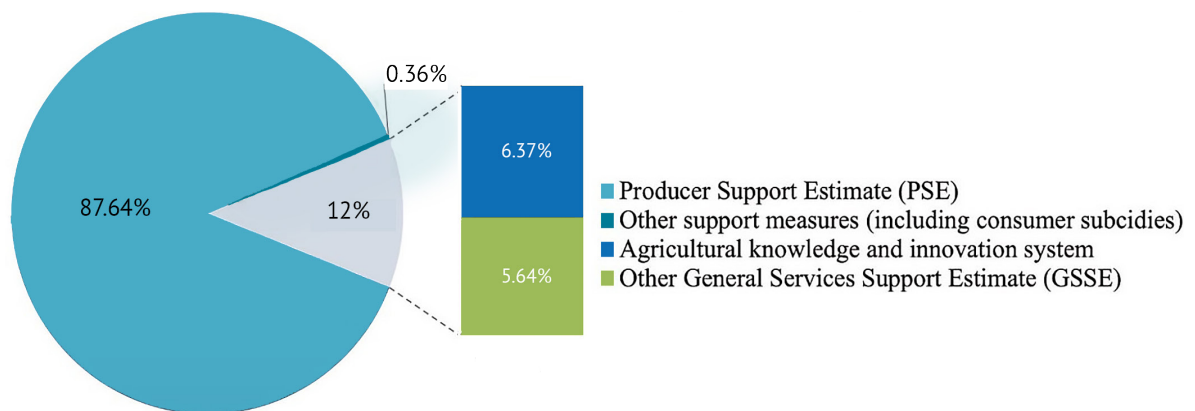

Figure 7. *The ratio of state support for producers and general services for the agrarian sector in the EU with an emphasis on financing agricultural knowledge and innovation*
Notes: *the amounts of funding for state support directions were averaged for 2017-2022 and determined in the TSE structure*
Source: *constructed by the author according to OECD (2023) data*

In Ukraine, despite a record decrease in total budget support (*TBSE*) by an average of 73.91% (from 2,082.54 million US dollars in 2011-2016 to 543.43 million US dollars in 2017-2022), the share of financing for agricultural knowledge and innovation (x_8) increased from 9.29% to 13.46% in the corresponding periods (Fig. 8). At the same time, there was an increase in the volume of financing for other general types of support for the agricultural sector (primarily inspections, pest and disease control, expenditures on veterinary and phytosanitary services (x_9)): from 9.59% to 27.20% in the same years. It indicated a slight shift in the government's focus on supporting general services for the agricultural sector (*GSSE*), as their share in 2022 increased by 21.93 pp compared to 2010.
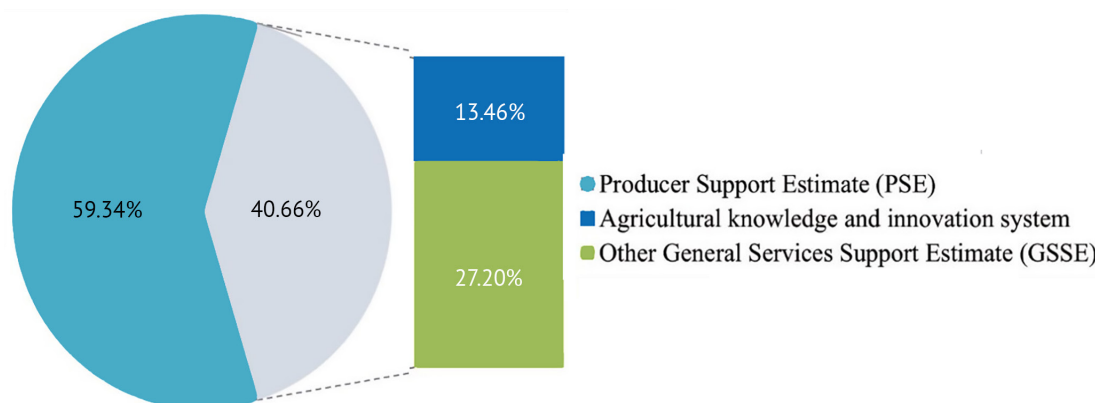

Figure 8. *The ratio of state support for producers and general services for the agrarian sector in Ukraine with an emphasis on financing agricultural knowledge and innovation*
Notes: *the amounts of funding by state support directions were averaged for 2017-2022 and determined in the structure due to the negative impact of market price support (MPS) and consumer support (CSE), which makes it impossible to correctly calculate the specific weight of types of state support in the TSE structure*
Source: *constructed by the author according to OECD (2023) data*

Thus, the model of state support in Ukraine had familiar features with the New Zealand concept in 1990-2000, which was in this period at the stage of transformation to a more balanced one, combining both short-term support for producers and supporting long-term development factors. But in addition to the fact that New Zealand did not subsidise consumers (x_{14}), another difference was that the competitiveness of Ukrainian products has not yet been able to compensate for the reduction in subsidies and other direct payments, although it should also be taken into account that the agricultural sector of Ukraine is forced to operate in much harsher conditions – against the backdrop of armed aggression. New Zealand had seen a modest increase in total support (*TSE*) in 2017-2022, at 3.15% compared to 2011-2016. However, its structure still reflected a model of agricultural support with minimal government intervention, which is aimed at creating long-term competitive advantages (productivity and quality) with an emphasis on funding knowledge and innovation rather than short-term support for producers.

The growth of *TSE* occurred primarily due to an increase in payments based on input use (x_2) and an increase in financing of other general services for the agricultural sector (in particular, control and inspection (x_9) from 39.84% in 2011-2016 to 41.19% in 2017-2022 (Fig. 9). At the same time, there was an increase in the value of agricultural production of 17.22% and reached an average of 20,859.71 million US dollars in 2017-2022. On the one hand, it does not deny the effectiveness of certain state support types, for which the amount of funding has increased. On the other hand, the increase in agricultural production could have occurred due to favourable market or foreign economic factors since New Zealand, like Ukraine, is a major agricultural product supplier to the world market, playing a crucial role in ensuring global food security.

According to the data obtained (Fig. 10), compared to New Zealand, Canada placed less emphasis on supporting agricultural knowledge and innovation (x_8) and financing general agricultural services, but they still outweighed the corresponding shares calculated for the EU. Despite the strong element of state intervention to ensure farmers' financial stability in times of crisis, compared to 2010, the share of x_8 increased by 0.69 pp in 2022, which indicated potentially larger volumes of support for the development of agricultural knowledge and innovation in the near future.
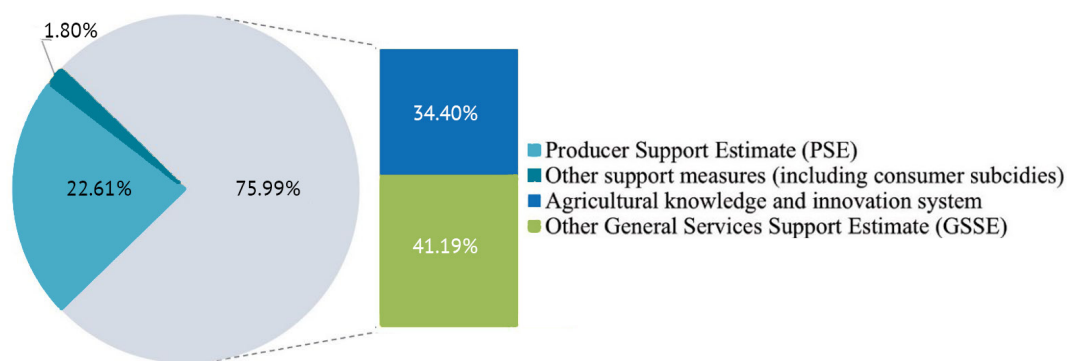
Figure 9. *The ratio of state support for producers and general services for the agrarian sector
in New Zealand with an emphasis on financing agricultural knowledge and innovation*
Notes: *the amounts of funding for state support directions were averaged for 2017-2022 and determined in the TSE structure*
Source: *constructed by the author according to OECD (2023) data*
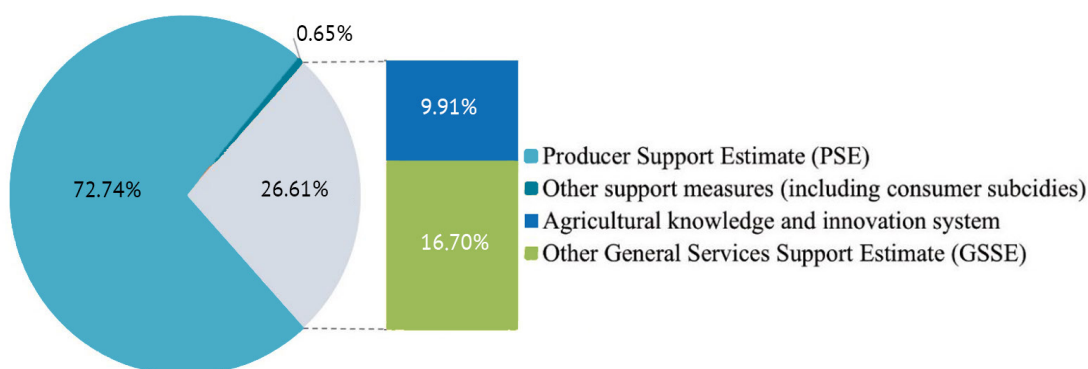

Figure 10. *The ratio of state support for producers and general services for the agrarian sector
in Canada with an emphasis on financing agricultural knowledge and innovation*
Notes: *the amounts of funding for state support directions were averaged for 2017-2022 and determined in the TSE structure*
Source: *constructed by the author according to OECD (2023) data*

The model of state support for USA agriculture contrasted perhaps the most with the models of other countries according to the criterion of the share of agricultural knowledge and innovations (x_8) since its average value in 2017-2022 was not only the smallest (2.59%) but also demonstrated a gradual decrease, since in 2022 its specific weight decreased by 0.74 pp compared to 2010 (Fig. 11).
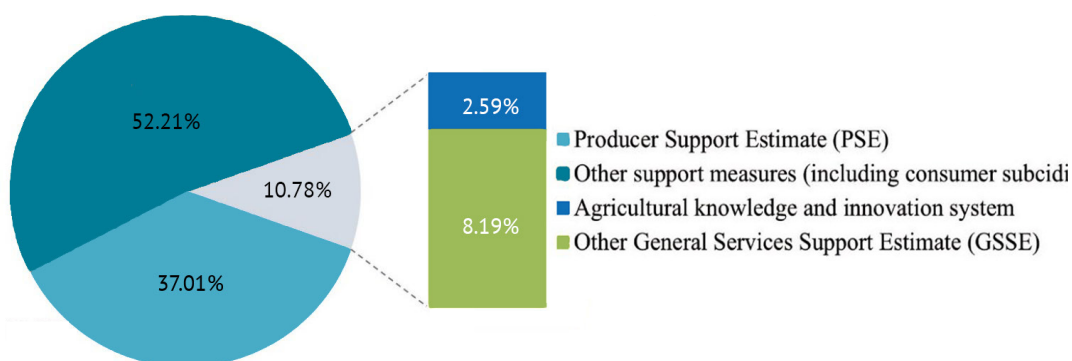

Figure 11. *The ratio of state support for producers and general services for the agrarian sector
in the USA with an emphasis on financing agricultural knowledge and innovation*
Notes: *the amounts of funding for state support directions were averaged for 2017-2022 and determined in the TSE structure*
Source: *constructed by the author according to OECD (2023) data*

Against the background of a reduction in funding for general services to the agricultural sector, which was different from the practices observed in the EU, Canada, and Ukraine models, the focus of state agricultural policy in 2017-2022 in the USA was the support of effective agro-logistics and transport infrastructure (x_{10}), which reached about 4% of the volume in the financing structure. The uniqueness of the USA support model was confirmed by the replacement of direct intervention in the farmers' production process with consumer subsidies for food products. By stimulating consumer demand, the USA indirectly supports agricultural producers while distorting market competition between them less. Based on the elasticity of direct producer support, in the EU (0.89) and Canada (0.50), the reduction of *PSE* was slower than *TSE*. At the same time, in the EU, although support for farmers remained the most substantial component of the model, direct producer support accounted for the reduction of *TSE* in 2017-2022 by (-7.96%) compared to 2011-2016 (-7.11%). For these reasons, the share of other indirect types of state support was increasing, financing the agricultural knowledge and innovation system (x_8) in particular. For Ukraine, $E_{(PSE/TSE)} = 1.09$, which, with negative increases in both indicators, indicated a greater reduction in *PSE* expenditures against the background of a general decrease in total support.

While in the USA model (0.91), the bulk of the *TSE* increase (+21.28%) was directed towards supporting the stability of producer incomes (+19.35%), for New Zealand, the consistent conclusion was the weak dependence of production support on the total: with a 1% increase in *TSE*, only 0.27% was directed in this path. Analysis of the absolute efficiency level and its change over time – the rate of budget support return (*RTBSE*) and the rates of its change (α_{1j} in univariate regression models) – demonstrated a low (*RTBSE* = 4.86), although relatively stable return on *TBSE* in the EU in 2010-2022.

In turn, the extremely high change rate for Ukraine ($\alpha_1 = 6.17$) indicated a transformation of the state support model, the reduced volumes of which did not have a proportional impact on the value of agricultural products. The rate of budget support return in New Zealand was the highest (*RTBSE* = 44.43), demonstrating a gradual and stable growth rate. While the USA had the lowest agricultural output per unit of budget support, which tended to decrease (-0.10), Canada demonstrated a stable agricultural policy with a moderate rate of return, which increased similarly to New Zealand.

Thus, based on the different stages of the above analysis, it was possible to distinguish four conceptual models of state support, which were presented in Table 2. Based on the analysis of $E_{VAP/TBSE}$, Ukraine should change the strategy of state agricultural policy since the current combined model of state support was characterised by negative elasticity ($E_{VAP/TBSE} = -0.10$). Its inefficiency lies in the fact that an increase in the volume of general budget support was accompanied by a decrease in the value of agricultural products and vice versa. Given the strong market reaction, the Canadian model, with a moderate producer priority, and the New Zealand model, with a priority for financing general services to the agricultural sector, can be a reference point for Ukraine. New Zealand had the most effective model of state support since even small amounts of funding directed to infrastructure, innovation, and quality control had a high effect on the value of agricultural products. Canada also had a high value of elasticity (1.75), which, although smaller compared to New Zealand (5.47), nevertheless indicated the effectiveness of budget support and its multiplier effect.

Table 2. *Comparison of conceptual models of state support for the agricultural sector in the EU, Canada, Ukraine, New Zealand, and the USA from the standpoint of its final beneficiaries*

Criterion/ Model/ Country	Model 1 with the priority support of direct producer support		Model 2 – hybrid/ balancing	Model 3 with the priority support of general services for the agricultural sector	Model 4 with the priority of consumer subsidies
	EU	Canada	Ukraine	New Zealand	USA
Indicators of structural and dynamic analysis of total state support (*TSE*)					
PSE Prevalence rate (KP_{PSE}) in 2017-2022	3.31	1.15	0.79	0.25	0.64
$E_{PSE/TSE}$ in 2017-2022 compared to 2011-2016	0.89	0.50	1.09	0.27	0.91
Average share of *PSE* in the GFR structure in 2010-2022	18.10%	9.93%	2.98%	0.66%	8.39%
Shift in the average share of *PSE* in the GFR structure in 2017-2022 compared to 2011-2016	-0.95%	-1.42%	-3.65%	-0.10%	0.84%
CSE Prevalence rate (KP_{CSE}) in 2017-2022	0.15	0.39	0.75	0.15	1.01

Table 2, Continued

Criterion/ Model/ Country	Model 1 with the priority support of direct producer support		Model 2 – hybrid/ balancing	Model 3 with the priority support of general services for the agricultural sector	Model 4 with the priority of consumer subsidies
	EU	Canada	Ukraine	New Zealand	USA
$GSSE$ Prevalence rate (KP_{GSSE}) in 2017-2022	0.12	0.24	0.30	2.32	0.13
Average share* of financing for agricultural knowledge and innovation in 2010-2022	6.04%	10.55%	11.38%	35.42%	2.61%
Top 5 dominant types* of state support in 2017-2022	X_5, X_3, X_1, X_2, X_8	X_1, X_3, X_9, X_8, X_2	$X_3, X_2, X_9, X_1, X_{13}$	$X_8, X_9, X_1, X_{10}, X_2$	$X_{14}, X_3, X_2, X_1, X_5$
Indicators of preliminary assessment of the total budget support effectiveness ($TBSE$)					
The rate of budget support return ($RTBSE$) in 2010-2022	4.86	11.66	39.66	44.43	4.35
Change rate (α_1) of the	0.08	0.23	6.17	0.57	-0.10
$E_{VAP/TBSE}$ in 2017-2022 compared to 2011-2016	0.13	1.75	-0.10	5.47	0.24
Impact on the value of agricultural products	Stable gradual growth due to the support of farmers' incomes		Disproportionate fluctuations that do not depend on state support	Stable active growth due to market self-regulation and high competition	Unstable growth due to fluctuations in consumer subsidies

Notes: *for Ukraine were determined in the TBSE structure due to the negative impact of market price support (MPS) and consumer support (CSE), which makes it impossible to correctly calculate the specific weight of the state support types in the TSE structure*
Source: *compiled by the authors*

The EU state support models, which focused on producer incomes, and the USA, with an emphasis on consumer subsidies, demonstrated less effectiveness: while for every 1% increase in *TBSE*, the value of agricultural products in the EU increased by only 0.13%, in the USA the elasticity was 0.24%. The results of the correlation analysis (Table 3) demonstrated a weighty statistical relationship between the preliminary estimates of effectiveness and the state support conceptual models: high statistical significance at the 0.05 level showed that the prevalence of support for general services to the agricultural sector (*GSSE*) and investments in the agricultural knowledge and innovation system (x_8) had a strong positive relationship with the elasticity of agricultural product value. It meant that, unlike other components of the state support structure, *GSSE*, in general, and x_8 were key factors in increasing the value of agricultural products, in particular.

Table 3. *Dependence of the elasticity of agricultural output value on the state support structure: results of correlation analysis*

Variables		*PSE* Prevalence rate	Average share of *PSE* in the GFR structure	*CSE* Prevalence rate	*GSSE* Prevalence rate	Average share of financing for agricultural knowledge and innovation (X_8)	Overall level of state support imbalance (D)
The elasticity of agricultural output value in 2017-2022 compared to 2011-2016	Pearson Correlation	-0.47	-0.55	-0.56	0.95*	0.94*	-0.74
	Sig. (2-tailed)	0.42	0.34	0.33	0.01	0.02	0.16

Notes: *correlation was statistically significant at the 0.05 level*
Source: *designed by the author*

Despite the lack of significance of other statistical relationships, the current analysis could formulate a working hypothesis that reducing the overall imbalance between state support directions has a positive impact on its effectiveness in the context of the elasticity of agricultural product value. In further studies, this hypothesis can be tested on a sample that includes a larger number of countries. Considering the state support structure through the prism of its key beneficiaries, the EU and Canada had a common model of state support, directing most of its volumes to farmers in the form of subsidies, grants, and other mechanisms with a relatively huger focus of the Canadian scheme on general services for the agricultural sector, in particular inspections and controls (x_9) and the system of knowledge and innovations (x_8). State support

concepts in New Zealand and the USA had a radically different orientation. The differences in their models made it possible to determine priority in the provision of general services to the agricultural sector and consumer subsidies, respectively.

Ukraine demonstrated a hybrid model, balancing between different state support directions. Despite the fact that the vector of the conceptual model development was not clearly defined due to state intervention in ensuring demand and food security against the background of armed aggression, the dynamics of *PSE* share in the GFR structure and the positive trend of KP_{GSSE} are likely signs of the priority of agricultural development in general in the long term. During the period of full-scale invasion and post-war reconstruction, given the significant destruction of the production capacities, housing and construction funds, and limited budgetary resources, the use of EU or USA models with significant direct financing of producers or consumers is inexpedient due to the significant burden on the state budget and its low efficiency, established on the basis of a preliminary assessment. However, during a period of full-scale invasion, the use of another extreme approach – the New Zealand model – creates significant risks to the stable functioning of the agricultural sector due to the lack of prerequisites for high productivity, developed infrastructure, and limited access to external markets.

Comparing conceptual models of state support in countries with highly developed agriculture provides a deep understanding of farming sector development strategies and the identification of the most effective approaches in different economic environments. I. Furman (2021) analysed the model of state support for agriculture in Ukraine, focusing on its distribution by budget programs, compared to the size and structure of state support in developed countries – Australia, Canada, the USA, France, and China. This approach is similar to that presented in the study, as it aimed to influence the formation of effective state policy in Ukraine based on best international practices. In the author's opinion, overcoming crisis phenomena through state support measures, which are reliable pillars for agricultural activity, strengthens food security. However, the comparison of world models in the article I. Furman (2021) was carried out without using unified criteria, focusing only on one indicator of the amount of state support per 1 ha of arable land, which, although might indicate the level of budget intervention, did not cover all the structural features of state support (indicators of structural and dynamic analysis of total state support) and did not allow for an assessment of its effectiveness (indicators of preliminary assessment of the total budget support effectiveness), which were proposed in Table 2.

Even though the assessment of the economic effectiveness of state support in the agricultural sector could be carried out using economic and mathematical modelling, in the study by V. Rusaniuk (2021), among several proposed methods, one of the efficiency criteria was the ratio of the volume of sold products to the volume of funds allocated to support agricultural production entities. This approach is logical, based on the principles of resource efficiency, with the indicator of the efficiency of used fixed assets in particular, utilised in the article by I. Umantsiv *et al.* (2021) as the ratio of the output volume in the sector to the unit cost of fixed assets. Since state support, like fixed assets, is a resource that affects the production potential of the industry, the proposed indicators in Table 2 enabled an initial assessment of the effectiveness of state support models. However, unlike V. Rusaniuk (2021), in the current study, agricultural output was calculated per unit not of direct producer support but of total budgetary support, which also considered the volume of general support – agricultural knowledge and innovations, inspections and control, infrastructure.

In addition, involving countries such as the EU, Canada, New Zealand, and the USA in the comparative analysis instead of Australia or China was more appropriate for Ukraine since their agricultural sector is export-oriented and has a high level of competitiveness in world markets, and therefore, their proven state support measures will contribute to the sustainability of the Ukrainian agricultural sector in the case of adaptation against the background of economic and climate instability. P. Yukhymenko *et al.* (2021) believed that when developing a new ideological platform for state support for the agricultural sector, the focus should be shifted from agroholding groups to small businesses. Investigating the principles of forming a model of state support for the farming sector of Ukraine in 2020 against the background of global trends, they proposed to take as a basis the priorities of the EU Common Agricultural Policy. The same idea was present in the study by S. Rogach *et al.* (2019), who having studied the experience of financial support in the EU, argued that Ukraine should take their model as a guideline since high amounts of funding ensure high results in agricultural production. Additional arguments in favour of adopting the EU concept within the framework of state policy, according to the authors, were not only Ukraine's European integration aspirations but also the effectiveness of state support measures in the context of solving social and environmental problems and intensification of the entrepreneurial activity development in rural areas. E. Erjavec *et al.* (2021), studying the process of accession of the Western Balkan countries to the EU,

generally considered the possibility of providing significant state support to be an implicit prerequisite for the accession of candidate countries to the EU.

Despite the arguments presented by the authors, the current study found that the EU has the highest level of imbalance in state support areas in 2017-2022 ($D = 6.43$) due to the absolute dominance of producer support, which, as a result, turned out to be a less efficient model compared to other countries, given the increase in the value of agricultural products by only 0.13% in the case of a 1% increase in *TBSE*. For these reasons, the statement of I. Mitchell & A. Baker (2019) was justified partially, as they believed that hundreds of billions of euros spent on agricultural subsidies did not contribute to the agricultural sector development and need to be used more effectively in the context of increasing instability, negative consequences of climate change and migration.

Thus, Ukraine's adaptation of the EU model with a significant level of producer subsidies was not recommended, which correlates with the conclusion of G. Pruntseva (2020), who suggested that a substantial amount of subsidies and benefits is not a guarantee of farm profitability and achievement of key goals. Since the mechanism of direct support for producers' incomes is widely used in the EU, which Ukraine is focusing on when building its economic and political system in the context of integration, Europe relies on powerful financial capabilities that Ukraine does not have, especially in the context of a full-scale invasion.

Although the agricultural sectors of Canada and the USA are also competitive and export-oriented, and production growth occurs due to structural changes, innovations, modern technologies, and developed infrastructure, the study demonstrated significant conceptual differences in their models. Although the Canadian model prioritised funding for producers, which made it similar to the EU, it was one of the most balanced ($D = 1.95$), also supporting the development of agricultural knowledge and innovation, inspections and controls, and other general support measures, which accounted for more than 25% of the funding structure in 2017-2022. It is consistent with the position of the Canadian Chamber of Commerce (2024), which emphasised that the continued high productivity and sustainable agriculture development, which is essential for a prosperous future, is achieved through innovation and new technologies, which provide national producers with a competitive advantage in the foreign market. According to them, Canadian agriculture is a vital sector, which, thanks to its competitiveness and sustainability, generated more than 7% of GDP and employs about 2.3 million workers.

The study by M. Yeung & W.A. Kerr (2021), which focused on the study of the opportunities of Canadian agri-food exports, also argued for Canada's competitiveness and its reliability as a supplier at the international level thanks to efficient supply chains, even despite the challenges caused by the COVID-19 pandemic. The authors emphasised that the country was the fifth largest exporter and major world producer supplying more than half of agricultural products to foreign markets. The competitiveness of the Canadian model was confirmed in the current study since with a stable and high return on budget support ($RTBSE = 11.66, \alpha_1 = 0.23$), with a 1% increase in budget spending, the value of agricultural products increased by 1.75%, second only to New Zealand. In addition to Canada, M. Yeung & W.A. Kerr (2021) also noted the United States as a competitive exporter of agricultural products to the world market. Moreover, A. Sulaiman *et al.* (2020) ranked the USA among the top three countries with the best competitiveness in the world, the main driver of which is the level of mastery of innovations. In addition, the Department of Agriculture, Fisheries and Forestry of the Australian Government (2021) characterised the impact of the USA agricultural sector on international markets as significant, and, being a large producer and exporter, changes in its production and agricultural policies cause transformations in the farming sectors of many countries around the world. According to their materials, about 76% of the state support structure was provided for domestic food aid programs, which was the largest expenditure direction. Although the results of the study determined a slightly lower share of funding aimed at supporting consumers (on average 47.44% in 2017-2022 and over 55% in 2022), their state support model was characterised by a significant level of imbalance ($D = 4.34$) precisely due to the absolute dominance of consumer support and the gradual curtailment of support for agricultural knowledge and innovations in federal funding in 2010-2022. Demonstrating similar estimates of the effectiveness of total budgetary support to the EU ($E_{y/TBSE} = 0.24$%), Ukraine should not take the American model of state support in general as a basis, the return of which tended to decrease in 2017-2022 compared to 2011-2016.

According to the Ministry of Agriculture and Food Sovereignty of France (2025), useful conclusions can be drawn from the agricultural policy of New Zealand, which practically stopped state intervention in agriculture and reduced direct support for producers almost 30 years ago, which made the country's experience valuable in the context of studying the consequences of eliminating state distortions and subjecting the sector development to the influence of exclusively market

forces. K. Bayne & A. Renwick (2021) also called New Zealand's model of state support an example for pursuing because, despite the abolition of agricultural subsidies, the country's farming sector is competitive globally. Above all, the role of the government is to invest in scientific research and development and create an environment where innovation can flourish. In such a model, the agricultural sector is in a system of light or low intervention, providing only general state support functions and with no direct intervention in the structure of farmers' incomes (Knook *et al.*, 2022).

The study results are fully correlated with the above statements because, according to the criterion of balance, the conceptual model of New Zealand was not only the closest to the balanced point of Euclidean space (D = 1.13) but prioritising support of general services for the agricultural sector, it also demonstrated the greatest return on budget support ($RTBSE$ = 44.43), and efficiency, since with an increase in volumes by 1%, the value of agricultural products increased by 5.47%. While C. Saunders (2019), analysing recent trends in agriculture in New Zealand and the United Kingdom, concluded that knowledge capital is particularly significant for ensuring sustainable agricultural development, increasing the sector's contribution to sustainable well-being, J. Foley (2022) still considered investment in research and development by both government and commercial organisations to been low, even though the share for agricultural knowledge and innovation was over 34% in the structure of state support in 2017-2022.

A comparison of the conceptual models of state support in the EU and New Zealand indicated the greater effectiveness of the latter: while with an average share of *PSE* in the GFR structure in 2010-2022 at the level of 0.66%, there was an active increase in the value of agricultural products in New Zealand, on the contrary, in the EU the growth was gradual, although the gross income of farmers was provided by state support by as much as 18.10%. The conclusions obtained are similar to the statement of B. Finney (2021), according to which, unlike the EU, the agricultural sector of New Zealand achieves significant results even with small amounts of state support, which does not prevent the country from being one of the world leaders in agriculture, exporting approximately 95% of agricultural products. In addition, the author suggested that the USA could use New Zealand's successful measures as a template for implementing the policy of reducing destructive amounts of financing within the framework of agricultural sector reform. Given that New Zealand is at the forefront of technological advances that allow for resource optimisation and increased production in both the livestock and horticultural sectors (Vannier *et*

al., 2022) as evidenced by the $E_{y/TBSE}$ values in 2017-2022 compared to 2011-2016, which for New Zealand were higher than in the USA (5.47% > 0.24%), the USA may indeed attempt to adapt those measures of the New Zealand model that are more efficient. W. Yang *et al.* (2020) noted that New Zealand's agriculture and dairy industries have been competitive internationally due to efficient production systems.

The state support model of Ukraine was not balanced (D = 3.17) since, in various turbulent periods, both producer support and consumer support were dominant for Ukraine, and there was an increase in the volume of financing for agricultural knowledge and innovations, inspections, and control, and other general types of support in 2017-2022. The study by N. Vdovenko *et al.* (2024) determined that the application of state, market, and metrological supervision is critically important for maintaining food safety and, therefore, may explain the observed increase in the specific weight of x_9 in 2017-2022. Such dynamics of the state support structure were also a likely consequence of the need to bring the quality of agricultural products closer to international standards, especially in the context of European integration. I.S. Konovalchuk & V.G. Kovalov (2023) shared the same opinion since, given Ukraine's course towards further integration into the EU, ensuring the proper quality level and safety of agricultural products and aligning the production system with European requirements is a fundamental direction for the state.

On the one hand, such a model is likely to have a positive impact on the productivity and competitiveness of the agricultural sector of Ukraine since the livestock industry of New Zealand, which is the basis of its economy, depends on the achievement of a high level of productivity to ensure international competitiveness, compliance with regulatory requirements, development and implementation of new technologies, as well as ensuring an adequate and targeted level of investment in research and development (Caradus, 2024). On the other hand, compensating for the negative impact of market risks in conditions of war, natural and climatic circumstances, and any other instability is entrusted to producers with limited financial capabilities since the Ukrainian government will only provide financing for the general development of the agricultural sector.

However, the most characteristic conceptual feature of the hybrid Ukrainian model of state support was an increase in the total budgetary support by 1%, which was accompanied by a decrease in the value of produced products by 0.10%, which cast doubt on the effectiveness of support in its current format. In the article by O.M. Ilchuk (2019), which assessed the level of state support for agricultural producers, the need to

increase its volume was argued by the fact that the implementation of state programs enabled the increase of production in the industry by 64.9% in 2017 compared to 2000. The study results refuted this statement by the author since without changing the model structure or conditions, an increase in the volume of state support will not give the desired result. In addition, the estimated increase in production volumes by almost 65% due to state support alone raised certain doubts, as agriculture development is influenced by many other factors (resource, natural and climatic conditions, and market conditions in foreign demands). Given the lack of statistically confirmed relationships in the study based on econometric models that could separate the impact of state support on agricultural production volumes from other factors and quantify it, the conclusion that the volume of state support by 2017 was the driving force of agricultural production is unlikely.

Based on an identical finding about the ineffectiveness of the state support model in Ukraine in 2010-2022, the current study did not hold completely the position of I. Dinis (2023) on the need to increase state support, especially if its measures (financial assistance to farmers, preferential lending and subsidies) will remain in the existing format. Since the results indicated a negative elasticity of the value of agricultural products comparatively to the total budgetary support (*TBSE*) in Ukraine, the change in funding did not have a positive effect on the dependent variable, which called into question the effectiveness of the mechanisms as a whole. Instead, before increasing the support volume, it is more appropriate to improve its structure with a focus on innovative and market-oriented measures, which have been tested in countries with a highly developed agricultural sector and the most effective conceptual models. In addition, subsidies and grants to producers, which, according to I. Dinis (2023), increase competitiveness in Ukrainian and foreign markets and ensure the growth of production volumes, remain the subject of scientific discussions regarding the effectiveness and impact on the long-term development of the agricultural sector. D. Amaglobeli *et al.* (2024), who studied the shortcomings of producer subsidy programs, believed that subsidies for agricultural production are often financially costly and unfavourable compared to alternative uses of government funds. Their article indicated that the efficiency and competitiveness of agricultural exports was the critical goal of countries relying on subsidy mechanisms. However, given $E_{y/TBSE}$ = 0.13%, which was calculated for the EU and turned out to be less than the corresponding indicators for New Zealand, Canada, and the USA, the stated goal was only partially confirmed in the Canadian case. A similar conclusion

was also present in the study by L. Petliuk & N. Miedviedkova (2021), who were analysed the state and key forms of financial support for the agricultural sector, considered the inefficiency of subsidies to be one of its problems. In their opinion, a set of shortcomings of the current system of state support should be eliminated, and only based on the results of the updated model the agricultural sector of Ukraine can develop.

N. Shyian & V. Kolosha (2020), comparing the development of the agricultural sector of Ukraine and New Zealand, concluded that although they are both large farming countries with export-oriented production, New Zealand demonstrated much more stable development. For these reasons, the article assumed that Ukraine lacks a similar economic mechanism, one of the most crucial elements of which was the policy of state support. This interpretation correlates with the statement of the current study about the chaotic and forced transformation of Ukraine's agricultural policy, which was close to the EU and Canadian model with a predominance of producer support (5.48%) in 2010-2013 but already in 2017-2022 the share of direct payments in the structure of agricultural producers' revenues was less than 1% due to Russian aggression and the redistribution of resources in favour of the national security and defence sector.

However, the lack of state support cannot be considered one of the central factors hindering the development of the Ukrainian agricultural sector, especially when compared with the New Zealand model, in which minimising state intervention, on the contrary, is a competitive advantage, not a negative feature. It was deregulation and the abolition of subsidies in the mid-1980s that stimulated increased mechanisation, investment in research and development, as well as innovation in the primary sector, which led to increased productivity (Eckhold, 2024), which should be the focus of Ukraine's agricultural sector development policy in the long term.

Nevertheless, despite the long-term benefits and the successful example of New Zealand encouraging production without subsidies, it took more than a decade for agricultural producers, who recognised that economic problems required reduced state intervention (Hall, 2021), to learn to function effectively without state support. In addition, in the case of a sharp adaptation of the New Zealand model, high competition may simultaneously eliminate Ukrainian producers with low productivity from the game, causing an economic shock. Based on the recommendations of H. Lysenko (2024) on the need to partially maintain direct producer support and restore state funding for livestock, since the full-scale invasion worsened the already critical situation, the application of the Canadian model of state support

is appropriate in the short-term perspective of post-war recovery. An additional argument in favour of the feasibility of adapting the state support model is that in Canada, compared to other key industries, leading agricultural sectors occupy high positions in terms of contribution to GDP and jobs (Windfeld & Lhermie, 2022), which is quite similar to Ukraine.

However, when implementing the Canadian model of state support, it is essential to hold its inherent focus on general sector services, which are key factors in increasing the value of agricultural products, as it was confirmed by the results of the correlation analysis in Table 3. In addition, technological innovations, infrastructure, knowledge, and innovation are fundamental since they are components of the Global Competitiveness Index, which is determined by the World Economic Forum and serves as a kind of assessment of the economic security level for countries that do not calculate it (Ivanov *et al.*, 2023). In this context, the role of the government in stimulating innovation and information and communication technologies in the agri-food sector is crucial because, according to L.F. Gutiérrez Cano *et al.* (2023), it leads to increased efficiency of agricultural tools and sustainable land use.

Thus, the results of the study showed that none of the analysed countries has a fully balanced model of state support for agriculture, which indicates the global complexity of building an effective agricultural policy. Ukraine, being in a wartime and post-war economy, demonstrates a hybrid approach to state support that requires targeted optimisation. Based on the structural and dynamic analysis and comparison with the models of countries with developed agricultural sectors, the article substantiates the feasibility of applying the Canadian model as an effective short-term solution, with a gradual transition to the New Zealand approach in the long term. Such a transformation will allow Ukraine to ensure stability, innovation and competitiveness of agriculture by adapting successful international practices to the national context.

CONCLUSIONS

The study demonstrated the lack of a balanced approach and significant differences in the conceptual models of state support for agriculture in the EU, Canada, New Zealand, the USA, and Ukraine, which are formed depending on the economic conditions and priorities of each country. While the EU had the highest overall level of imbalance due to the absolute dominance of direct payments to producers, in the USA, support in the form of consumer subsidies played a dominant role with a relatively low level of financing for agricultural infrastructure and innovations. Canada had a similar model of state support to the EU with a priority for producers,

but on a smaller scale, paying more attention to the development of the agricultural sector as a whole compared to the EU and the USA, which led to a high and positive value of the elasticity of the value of products depending on the level of aggregate support. New Zealand used a fundamentally different approach, focusing on ensuring the competitiveness of the agricultural sector and the highest level of self-sufficiency and autonomy of producers, minimising their dependence on state support due to the predominant financing of the agricultural knowledge system, innovations, inspections, and quality control of products. At the same time, this model demonstrated the greatest efficiency because even small amounts of financing directed to innovations, infrastructure, and quality control provided the maximum economic effect for the value of agricultural products.

According to the results of the correlation analysis, since the prevalence of support for general services to the agricultural sector and investments in the agricultural knowledge system and innovations were key factors in increasing the value of agricultural products, countries that seek to increase the competitiveness of agriculture should shift the emphasis of state support from direct support for producers or consumers towards long-term investments in infrastructure, research, and technological development. Based on the fact that, according to the results of economic and statistical analysis, Ukraine did not have a stable and balanced policy, demonstrating the inefficiency of the current hybrid model of state support, the optimal solution is the Canadian approach with moderate support for producers and an emphasis on agricultural knowledge, innovation, verification, and control or the New Zealand approach with support for general services for the farming sector.

However, it is worth considering that a complete rejection of *PSE* in the short term is risky, and, therefore, the strategy of Ukraine's agricultural policy should, for the present, combine both state intervention with the preservation of moderate direct support in order to urgently stabilise the situation in regressive areas of agricultural production, and stimulate the growth of competitiveness, in particular through investments in technological renewal, infrastructure, knowledge, and innovation, which was characteristic of the Canadian model. In turn, in the long-term post-war perspective, the use of the New Zealand conceptual model is more appropriate for Ukraine, as it demonstrated the possibilities of reducing the dependence of the agricultural sector on direct state support without a critical decrease in the value of agricultural products, which was steadily growing due to market competition. A promising direction for further scientific research is to identify not only the prevailing directions and state support types for

each of the conceptual models but also those measures that have a reliable and statistically confirmed impact on the value of agricultural products based on linear multiple regression models or production functions. It will contribute to a deeper understanding of the impact of individual state support types in the EU, Canada, New Zealand, and the USA and to Ukraine's adaptation of not only proven measures but also effective measures.

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Концептуальні моделі державної підтримки сільського господарства: від безпосередньої допомоги виробникам до фінансування загальних аграрних послуг

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Анотація. Оскільки концепція державної підтримки сільського господарства України не є довершеною і вимагає вдосконалення, зважаючи на обмежені фінансові можливості країни під час повномасштабного вторгнення та повоєнного відновлення, метою статті був пошук оптимальної моделі державної підтримки, що спирається на досвід країн з високорозвиненим сільськогосподарським сектором. Особливості концептуальних моделей державної підтримки розглядались через низку показників структурно-динамічного аналізу та оцінок ефективності бюджетної підтримки в ЄС, Канаді, Новій Зеландії, США та Україні. Передумовою дослідження став аналіз загального рівня дисбалансу напрямків державної підтримки сільського господарства, за результатами розрахунку якого жодна з країн не мала збалансованого підходу до регулювання агросектору. Встановлено, що причиною найбільших рівнів дисбалансу в ЄС було беззаперечне домінування прямої підтримки виробників, а в США – підтримки споживачів одночасно з низькою пріоритетністю розвитку сільськогосподарських знань та інновацій в обох країнах. Для України характерною виявилась гібридна модель державної підтримки, оскільки у різні періоди турбулентності переважали різні її напрямки. З огляду на оцінку ефективності концептуальних моделей Україні у короткостроковій перспективі необхідно використовувати канадську модель, що, хоч і подібна до ЄС, але у значно менших масштабах підтримує фермерів, і має відносно більший фокус на загальних послугах для агросектору, зокрема перевірках та контролю і аграрних знаннях та інноваціях. Встановлено, що у довгостроковій перспективі пріоритетною є адаптація новозеландського підходу з абсолютним домінуванням інвестицій в інфраструктуру, науково-дослідницьку діяльність та технологічний розвиток, що забезпечує максимальний економічний ефект та конкурентоспроможність галузі. Отримані результати дослідження можуть бути використані органами державної влади України, зокрема Міністерством аграрної політики та продовольства, для вдосконалення програм державної підтримки сільського господарства шляхом адаптації ефективних моделей фінансування, що базуються на міжнародному досвіді та враховують економічні й ресурсні реалії країни

Ключові слова: агросектор; Україна; рівень дисбалансу державної підтримки; ефективність; вартість сільськогосподарської продукції; аграрні знання та інновації; Нова Зеландія