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Improvement of Crop Production Planning in Ukraine Using the Cobb-Douglas Production Function

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► **Abstract.** The relevance of the study is conditioned by the need to improve the process of planning the crop production by agricultural enterprises of Ukraine through the construction of a functional relationship between the results of production activities of enterprises and the factors that determine these results. The purpose of the study is to improve the process of planning crop production by agricultural enterprises of Ukraine through the development of an econometric model in the form of a Cobb-Douglas production function. To model the processes of crop production, it is proposed to use the Cobb-Douglas production function, which describes the dependence of the crop production index on the indices of agricultural land acreage and labour productivity. Based on statistical information for 1996-2020, unknown parameters of the Cobb-Douglas production function were found by regression analysis. The high quality of the constructed model is substantiated. High predictive properties of the model are proved. To analyse the efficiency of resource use in crop production by agricultural enterprises, the coefficients of average, marginal products of labour and capital are calculated. The sensitivity of crop production to changes in crop areas and labour productivity is investigated. It is determined that if the index of agricultural areas is increased by 1%, the index of crop production will increase by 0.77%; and if the index of labour productivity is increased by 1%, the index of crop production will increase by 0.81%. An increasing return on the scale of resources spent is revealed, which indicates an increase in production volumes with an increase in the volume of resources in the crop production industry

► **Keywords:** econometric model, model quality assessment, forecast, resource efficiency, output elasticity, economies of scale, agricultural enterprises

► Introduction

The development of methods for forecasting the production activities of business entities, evaluating and analysing the efficiency of their management using objective dependencies between the results of activities and the factors that determine these results are modern ways of improving the production planning process. Methods for evaluating and analysing the effectiveness of the functioning of business entities can be divided into two groups.

Methods of the first group involve the use of financial and economic coefficients that characterise economic activity. In [1], the advantages and disadvantages of using these methods are indicated. The advantage of using financial and economic coefficients for evaluating and analysing the performance of business entities is the simplicity of their calculation. The disadvantages of using these methods include the following: 1) analysis of an individual coefficient can only evaluate a part of the activity. Assessment of the efficiency of all production activities involves

the analysis of a large number of coefficients, which leads to its complication; 2) there is a paradox [2], in which a business entity that has better financial and economic indicators than another has a lower overall efficiency; 3) when comparing the efficiency of business entities whose results differ significantly, relative coefficients are used. They are calculated as the ratio of performance results to resources spent. Thus, the existence of only a stable return on the scale of activities is assumed; 4) for the overall assessment of the effectiveness of activities, financial and economic coefficients with weighting coefficients determined by experts are used. This makes the assessment subjective. The disadvantages of coefficient analysis of the activity of complex systems are investigated in [3].

The methods of the second group are based on the concept of efficiency limits. The efficiency of business entities is calculated considering the approximation of the values of performance indicators

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of an individual entity to the efficiency limit. There are parametric and nonparametric methods for approximating the efficiency limit. Parametric methods define the functional form of a production function, the parameters of which are determined by econometric methods. Nonparametric methods perform a piecewise linear approximation of the effective limit by mathematical programming methods. Parametric methods can analyse the influence of factors of production on one of the results of production. Nonparametric methods can analyse the influence of several factors of production simultaneously on the results of production. The advantage of parametric methods is the consideration of observation errors in the initial data, while nonparametric methods are flexible in approximation. The efficiency estimated by parametric methods is sensitive to changes in the input and output values, and the composition of the studied population. Efficiency estimated by nonparametric methods is sensitive to changes in the input, output values, and composition of only fully efficient business entities. Nonparametric methods determine the relative efficiency, that is, the efficiency of an individual economic entity relative to others. Parametric methods evaluate and analyse the effectiveness of an individual business entity.

The study of the efficiency of crop production by agricultural enterprises of Ukraine will be carried out using the parametric method, which is based on determining the functional form of the Cobb-Douglas production function. The Cobb-Douglas function determines the relationship between the volume of production and the costs of two types of resources involved in production (labour and natural resources, fixed assets, investments, etc.). The use of this function allows predicting and planning production volumes, identifying the contribution of each resource to the overall growth of production, evaluating the efficiency of production and resource use, determining the possibility of their interchangeability, identifying the impact of the scientific and technical process on production processes, the type of economic growth (extensive or intensive), and assessing the scale of production and its impact on production efficiency. The Cobb-Douglas production function can be used to analyse and predict the production activities of both individual business entities and economic associations, sectors of the economy. Thus, the use of the Cobb-Douglas function for planning crop production by agricultural enterprises in Ukraine is relevant.

There are many scientific studies devoted to the theory and practice of applying the Cobb-Douglas production function to assess the processes of production activities of various business entities. Among the foreign researchers who have been engaged in these studies in recent years: V. Akhundov [4], F. Cysneiros, V. Leiva, S. Liu [5], R. Smirnov R., K. Wang, Z. Wang [6], M. Hadush [7], Y. Yang, L. Yang, Shou Yi Liu [8], P. Ghoshal, B. Goswami [9] et al. The study by V. Akhundov [4] deals with the problem of predicting the regional final product using the Cobb-Douglas

fuzzy model. F. Cysneiros, V. Leiva, S. Liu [5] proposed a methodology for modelling the Cobb-Douglas function with stochastic constraints. In the study by R. Smirnov, K. Wang, Z. Wang [6] the Cobb-Douglas production function is constructed considering the exponential growth of production. In the study by M. Hadush [7] using the Cobb-Douglas function, the relationship between agricultural production, agricultural labour costs, and resource scarcity are studied. In the study by Y. Yang, L. Yang, Shou Yi Liu [8], the Cobb-Douglas function is constructed to analyse the impact of capital and labour on the economic growth of agriculture in one of the provinces of China. P. Ghoshal, B. Goswami [9] proposed to use the Cobb-Douglas production function to measure the efficiency of agriculture in individual regions of India, and identified factors affecting the efficiency and inefficiency of agricultural production. Among the Ukrainian studies devoted to the application of the Cobb-Douglas production function, the following works can be mentioned: B. Hrabovetskyi [10-12], O. Fomina, N. Hoholieva, Yu. Labuzova [13], Yu. Kharazishvili, V. Liashenko [14], S. Shumska [15; 16], V. Yankovyi [17] et al. B. Hrabovetskyi [10] defined the essence and areas of using production functions in production management, highlighted the need to consider the features of the industry under study when forming the composition of factors of production function, and revealed the features of using the Cobb-Douglas function for the sugar beet industry. In the studies [11; 12], B. Hrabovetskyi investigated the use of production functions in the production management of certain branches of the food industry of Ukraine, namely, fat and oil, confectionery, and sugar beet industries. A. Fomina, N. Hoholieva, Yu. Labuzova [13] constructed the production function of the Ukrainian economy and gave recommendations for improving the economic growth policy. Yu. Kharazishvili and V. Liashenko [14] developed a modification of the Cobb-Douglas function to assess the innovative contribution to economic growth, in particular, in the old industrial regions of Ukraine. S. Shumska [15] presented the main steps of constructing the Cobb-Douglas production function for the Ukrainian economy. V. Yankovyi [17] developed theoretical and methodological aspects of modelling the growth factors of an enterprise based on production functions.

Analysis of publications devoted to the theory and methodology of production functions indicates that in recent years, researchers have paid attention to the use of various modifications of the Cobb-Douglas function, including applied research on the use of the Cobb-Douglas function at the macro and micro levels of the economy. The issues of applying the Cobb-Douglas production function for forecasting, evaluating agricultural production processes in Ukraine, and analysing the causes of inefficient activities have not been fully investigated.

The purpose of the study is to determine the specifics of applying the Cobb-Douglas production function to improve the planning of crop production by agricultural enterprises of Ukraine.

► Materials and Methods

Economic statistics data for building an econometric model of crop production planning by agricultural enterprises of Ukraine in the form of the Cobb-Douglas production function is obtained from the official website of the State Statistics Service of Ukraine and the statistical collection "Agriculture of Ukraine" (2021). Including statistical data of the index of crop production in agricultural enterprises for the period 1996-2009 obtained from the website of the State Statistics Service of Ukraine from the section "Indices of agricultural products (1991-2009)", and for the period 2010-2020 – from the statistical collection "Agriculture of Ukraine" (2021). Statistical data of the index of agricultural land areas are calculated based on statistical data of agricultural land areas in crop production, which are obtained from the website of the State Statistics Service of Ukraine from the section "Crop production (1991-2020)". Statistical data of the index of labour productivity in agricultural enterprises in crop production was obtained from the website of the State Statistics Service of Ukraine from the sections "Indices of agricultural products (1990-2009)" and "Indices of agricultural products (2010-2020)".

The study was conducted using a generalised heuristic method, which included the following stages:

1. Preliminary statement of the research task:
 - 1) determination of the object of modelling (crop production by agricultural enterprises of Ukraine);
 - 2) modelling goals (analysis, forecast, planning of crop production by agricultural enterprises of Ukraine);
 - 3) modelling apparatus (parametric classes of functions);
2. Investigation and analysis of the research task:
 - 1) collection and study of information on the research topic;
 - 2) assessment of the degree of relevance of the study;
3. Clarification and detailing of the problem statement:
 - 1) selection of the type of parametric function (production function) and its modifications (Cobb-Douglas function);
 - 2) determination of input and output parameters of the production function (development of the composition of factors of the production function considering the characteristics of the crop production industry, checking the tightness of the relationship between input and output factors, selection of the most important factors);
4. Implementation of the research task (determination of unknown model parameters, analysis of the quality of the model and its predictive properties);
5. Analysis and evaluation of the solutions found.

The study also applied the following methods: 1) statistical research (for collecting, processing, and analysing the initial data, which included assessing the tightness of the relationship between the initial data based on calculated paired and partial correlation coefficients); 2) economic and mathematical modelling (for choosing the form of dependence of the Cobb-Douglas production function); 3) econometric

modelling (for building the Cobb-Douglas production function based on statistical data); 4) correlation and regression analysis (for analysing the quality of the constructed model and its forecast properties); 5) special (parametric method for approximating the efficiency limit, least squares method for determining unknown parameters of the Cobb-Douglas function); 6) computer (using the MS Excel add-in "Search for a solution" to determine the parameters of the Cobb-Douglas function and standard MS Excel functions for analysing its quality and predictive properties); 7) abstract and logical (for drawing conclusions).

► Results and Discussion

In 1928, the American mathematician, economist C. Cobb and the American economist P. Douglas proposed the following mathematical model of the dependence of output volumes on labour and capital [18] (1):

$$Q = AL^\alpha K^{1-\alpha} \quad (1)$$

where Q – production volume; L – labour costs; K – capital expenditures; A, α – positive coefficients that characterise the production technology.

Currently, the improvement of the Cobb-Douglas production function is carried out in the following areas [19]:

- use of relative values, a wide range of variables that reflect different types of factors of production;
- accounting for conditions of uncertainty and turbulence of the external environment;
- accounting for the delay in the results of production activities in relation to the time of influence of factors due to the use of lag variables;
- consideration of the impact of technological progress, innovative factors of economic growth, and labour quality;
- accounting for the impact of climate factors through the use of fictitious variables;
- application of correlation and variance analysis to determine the degree of influence of factors on production results, etc.

Improvement of crop production planning by agricultural enterprises of Ukraine will be carried out through the development of an econometric model in the form of the Cobb-Douglas production function (2):

$$Y = b_0 K^{b_1} L^{b_2} \quad (2)$$

where b_0 – proportionality or scale factor; Y – index of crop production in agricultural enterprises; K – index of agricultural land areas; L – index of labour productivity in agricultural enterprises in the field of crop production; α, β – coefficients of elasticity for capital and labour, respectively.

The study approximates the data in Table 1 by equation (2).

Table 1. Initial data for constructing the Cobb-Douglas function for planning crop production by agricultural enterprises of Ukraine (1996-2020)

Year	Index of crop production in agricultural enterprises (y_i) [20; 21]	Index of agricultural land area (K_i) [22]	Index of labour productivity in agricultural enterprises, crop production (L_i) [23; 24]
1996	81.2	95.27	86.4
1997	110.7	107.8	111.2
1998	78.1	93.7	82.3
1999	91.5	99.28	92.4
2000	105.4	102.42	112.3*
2001	122.4	107.56	127.7*
2002	94.1	100.3	117.8*
2003	70.3	91	92.4
2004	155.5	112.01	176.4
2005	96.6	98.38	110.4
2006	106.1	99.22	113.7
2007	89.9	99.99	96.8
2008	148.8	104.44	150.2
2009	90.2	100.23	97.4
2010	94.6	99.01	97
2011	134.9	104.03	125.3
2012	91.0	100.45	92.4
2013	123.6	101.61	129.5
2014	103.9	94.82	108.2
2015	94.5	98.26	95.8
2016	112.4	103.16	121.8
2017	96.2	100.96	96.7
2018	113.6	101.09	115.8
2019	102.5	101.02	106
2020	85.8	102.66	89.4

Note: * – Index of labour productivity in agricultural enterprises

Source: State Statistics Service of Ukraine [20-24]

The unknown parameters of the function (2) are calculated using the least-squares method from the following equation (3):

$$\sum_{i=1}^n e_i^2 = \sum_{i=1}^n (y_i - Y_i)^2 = \sum_{i=1}^n (y_i - b_0 \cdot K_i^{b_1} \cdot L_i^{b_2})^2 \rightarrow \min \quad (3)$$

where y_i – actual indices of crop production in agricultural enterprises, n – the number of observations, $n=25$.

It is possible to minimise the function (3) using

the MS Excel add-in “**Search for a solution**”, the application of which does not require the linearisation of the function, which leads to a shift in parameter estimates. As a result, the following coefficient values are obtained: $b_0=0.06$, $b_1=0.77$, $b_2=0.81$.

Therefore, the regression equation (3) will have the following form (4):

$$Y = 0.06K^{0.77}L^{0.81} \quad (4)$$

Table 2 shows indicators for evaluating the overall quality of the model (4).

Table 2. Indicators for evaluating the overall quality of the Cobb-Douglas function for planning crop production by agricultural enterprises of Ukraine

Indicators	Equation	Calculated value
Coefficient of determination	$R^2 = 1 - \frac{\sum (y_i - \bar{y})^2}{\sum (y_i - \bar{y})^2}, \bar{y} = \frac{1}{n} \sum y_i$	0.89
Multiple coefficient of determination	$R = \sqrt{R^2}$	0.95
Adjusted coefficient of determination	$\bar{R}^2 = 1 - (1 - R^2) \frac{n-1}{n-m-1}$ m – the number of explanatory variables, $m=2$.	0.88
Standard approximation error	$S = \sqrt{\frac{\sum e_i^2}{n-m-1}}$	7.04

Source: calculated by the author

Analysis of the calculated indicators for evaluating the overall quality of the model indicates a high quality of the model (4). The calculated value of the coefficient of determination $R^2=0.89$ indicates that 89% of the statistics are approximated by the constructed model. Next, the study analyses the statistical significance of the calculated coefficient of determination. First, the value of F – Fischer's criterion is calculated by equation (5):

$$F = \frac{R^2}{1 - R^2} \frac{n - m - 1}{m} \quad (5)$$

Table 3. Indicators for evaluating the forecast properties of the Cobb-Douglas function for planning crop production by agricultural enterprises of Ukraine

Indicators	Equation	Calculated value
Average forecast error	$ME = \frac{1}{n} \sum_{i=1}^n e_i$	0.04
Average absolute percentage error	$MAPE = \frac{1}{n} \sum_{i=1}^n \left \frac{e_i}{y_i} \right 100\%$	4.5%
Average percentage error	$MPE = \frac{1}{n} \sum_{i=1}^n \frac{e_i}{y_i} 100\%$	-0.5%
Average approximation error	$V = \frac{S}{y} 100\%$	6.8%

Source: calculated by the author

Next, the study analyses the predictive properties of the constructed model (4) based on the indicators from Table 3. The average forecast error characterises the degree of forecast bias [25]. If the forecast values are generally overestimated, then $ME < 0$, if underestimated – $ME > 0$. The calculated value of the average forecast error of the model (14) $ME \approx 0$, which indicates that there is no bias in the forecast. It is considered [25] that if the calculated value $MAPE$ is less than 10%, then the model provides high forecast accuracy. If the value changes in the range from 10 to 20%, then the model provides good accuracy, and in the range from 20 to 50% – satisfactory accuracy. Value $MAPE$ more than 50% indicates unsatisfactory forecast accuracy. Based on calculations: $MAPE \approx 4.5\%$. Since the calculated value $MAPE$ is less than 10%, then the forecast for the constructed model will be highly accurate.

The average percentage error is an indicator of forecast bias and should not exceed 5% [25]. Based on calculation, $MPE = -0.5\%$, i.e., there is no offset. The value of the average approximation error determines a relative forecast error. Based on the calculation results: $V \approx 6.8\%$, in other words, the model provides high forecast accuracy. Therefore, the predictive properties of model (4) are high. The constructed Cobb-Douglas production function allows forecasting the volume of crop production by agricultural enterprises of Ukraine and analysing the efficiency of using agricultural land and labour resources. Next,

Thus, $F=92.94$. Using the Fischer critical point tables, the critical value $F_{cr}(\alpha; m; n-m-1) = F_{cr}(0.05; 2; 22) = 3.44$ is found. Since the calculated value – the coefficient of determination is statistically significant and correctly reflects the quality of the model.

The forecast properties of the model (4) are estimated by the indicators of the absolute average percentage error of the forecast and the average approximation error. Table 3 shows indicators for evaluating the predictive properties of the model (4).

the study determines the average labour productivity and average fund return using equations (6-7):

$$AP_L = \frac{Y}{L} = \frac{0.06K^{0.77}L^{0.81}}{L} = 0.06K^{0.77}L^{-0.19} \quad (6)$$

$$AP_K = \frac{Y}{K} = \frac{0.06K^{0.77}L^{0.81}}{K} = 0.06K^{-0.23}L^{0.81} \quad (7)$$

Average values of coefficients calculated for the period 1996-2020 AP_L , AP_K are equal to 0.86 and 0.93, respectively. This means that on average, 1% of the labour productivity index in agricultural enterprises accounts for 0.86% of the crop production index and 1% of the agricultural land area index accounts for 0.93% of the crop production index.

Next, the study determines the marginal productivity and marginal fund return using equations (8-9):

$$MP_L = \frac{\partial Y}{\partial L} = (0.81)(0.06)K^{0.77}L^{-0.19} = 0.049K^{0.77}L^{-0.19} \quad (8)$$

$$MP_K = \frac{\partial Y}{\partial K} = (0.77)(0.06)K^{-0.23}L^{0.81} = 0.046K^{-0.23}L^{0.81} \quad (9)$$

Average values of coefficients calculated for the period 1996-2020 MP_L , MP_K are equal to 0.70 and 0.71, respectively. This means that on average, 1% increase in the labour productivity index accounts for 0.70% of the increase in the crop production index; and 1% increase in the agricultural land area

index accounts for 0.71% of the increase in the crop production index.

When modelling, it is important to find out how sensitive the value of the dependent variable Y is before changing factors K and L . It is known that the parameters b_1 and b_2 represent the elasticity of output by capital (b_1) and for labour (b_2). It is considered that an increase in capital expenditures by 1% leads to an increase in output by $b_1\%$, and an increase in labour costs by 1% – to an increase in output by $b_2\%$.

Calculated value of elasticity of crop production output by area of agricultural land $E_{Y,K}=b_1=0.77$ means that if the agricultural area index is increased by 1%, the crop production index will increase by 0.77%. Elasticity of crop production output in terms of labour productivity $E_{Y,L}=b_2=0.81$ means that if the labour productivity index is increased by 1%, the crop production index will increase by 0.81%. Since the elasticity of crop production output in terms of productivity is greater than the elasticity of output in terms of sown areas, agricultural enterprises use labour more intensively than capital. Since the values of the elasticity coefficients $E_{Y,K}$, $E_{Y,L}$ are less than one, – the output of crop production is relatively inelastic in terms of labour and crop area.

It is known that if $b_1+b_2>1$, then equation (4) has an increasing effect on the scale of production. This means that when increasing K and L in some proportion, Y increases in a larger proportion. If $b_1+b_2=1$, – there is a constant effect on the scale of production. This means that Y increases in the same proportion as K and L . If the condition $b_1+b_2<1$ is met, there is a negative effect. This means that Y increases in a smaller proportion than K and L . Therefore, using the Cobb-Douglas function, it is possible to estimate the degree of return on the scale of production. Next, the study calculates the return on the scale of production studied using the equation (10):

$$b_1 + b_2 = 0.77 + 0.81 = 1.58 > 1 \quad (10)$$

Thus, a growing return on scale is obtained. This means that the increase in crop production is carried out in a larger proportion than the increase in acreage and labour productivity.

► Conclusions

In the study, the improvement of crop production planning by agricultural enterprises of Ukraine is carried out through the development of the Cobb-Douglas production function. The paper proposes a production function that describes the relationship between the index of crop production by agricultural enterprises of Ukraine and the indices of agricultural land areas and labour productivity. The parameters of the Cobb-Douglas production function are determined and the high quality of the constructed model is proved. To predict the constructed function, the predictive properties of the model are estimated and it is proved that the predictive properties of the model are high. To analyse the efficiency of using resources in the production process under study, the coefficients of average, marginal products of labour and capital are calculated. It is determined how much of the crop production index accounts for an average of 1% of the labour productivity index (0.86%) and 1% of the agricultural land area index (0.93%) during the study period. It is determined how much the average 1% increase in labour productivity indices and agricultural land areas accounts for the increase in the crop production index (0.70% and 0.71%, respectively). It is revealed how sensitive the value of crop production is to changes in crop areas and labour productivity. It is determined that an increase in the agricultural area index by 1% leads to an increase in the crop production index by 0.77%, and an increase in the labour productivity index by 1% leads to an increase in the crop production index by 0.81%. Thus, investment in labour resources and capital gives approximately the same effect in the growth of crop production. The presence of an increasing return on the scale of production is revealed, which indicates the feasibility of further expansion of the crop production industry.

The findings can be used in planning the crop production by agricultural enterprises, analysing the efficiency of production and resource use. The use of the developed model would allow making informed management decisions in conditions of uncertainty and turbulence of the external environment.

The prospect of further study is the analysis of priority areas of agricultural production in Ukraine using the method of production functions.

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Вдосконалення планування виробництва продукції рослинництва в Україні за допомогою виробничої функції Кобба-Дугласа

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► **Анотація.** Актуальність дослідження обумовлена необхідністю вдосконалення процесу планування виробництва продукції рослинництва сільськогосподарськими підприємствами України через побудову функціональної залежності між результатами виробничої діяльності підприємств та факторами, що обумовлюють ці результати. Мета статті – вдосконалити процес планування виробництва продукції рослинництва сільськогосподарськими підприємствами України через розробку економетричної моделі у вигляді виробничої функції Кобба-Дугласа. Для моделювання процесів виробництва продукції рослинництва в роботі запропоновано використовувати виробничу функцію Кобба-Дугласа, яка описує залежність індексу продукції рослинництва від індексів площ посівів сільськогосподарських угідь та продуктивності праці. На основі статистичної інформації за 1996–2020 рр., методами регресійного аналізу знайдені невідомі параметри виробничої функції Кобба-Дугласа. Доведено високу якість побудованої моделі. Доведено високі прогностні властивості моделі. Для аналізу ефективності використання ресурсів при виробництві продукції рослинництва сільськогосподарськими підприємствами розраховані коефіцієнти середніх, граничних продуктів праці та капіталу. Досліджено чутливість величини випуску продукції рослинництва до зміни площ посівів та продуктивності праці. Визначено, що якщо індекс сільськогосподарських площ збільшити на 1 %, то індекс продукції рослинництва збільшиться на 0,77 %, а якщо індекс продуктивності праці збільшити на 1 %, то індекс продукції рослинництва збільшиться на 0,81 %. Виявлено зростаючу віддачу від масштабу витрачених ресурсів, що свідчить про збільшення обсягів виробництва при збільшенні обсягів ресурсів в галузі рослинництва

► **Ключові слова:** економетрична модель, оцінка якості моделі, прогноз, ефективність використання ресурсів, еластичність випуску продукції, ефект масштабу, сільськогосподарські підприємства



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Prospects for the Development of the Seed Industry in Ukraine

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► **Abstract.** Given the significant production and export potential of the crop sector in Ukraine, it is important to develop an effective national seed production system. Providing agricultural producers with seeds of national selection is one of the main factors of food security in the country. The development of an effective seed production system provides for the creation of appropriate conditions for increasing seed production and popularising national varieties and hybrids that have a significant yield potential and high-quality indicators for their wider use, which will ensure the competitive advantages of agricultural production and its development. The purpose of the study is to identify trends and outline development prospects for the seed industry of Ukraine. In the course of the study, the dialectical method, analysis and synthesis, system generalisation (establishing trends in the development of the Ukrainian seed industry; forming conclusions), and comparative analysis (determining the main problems of seed production development in Ukraine) were applied. Trends in the development of the seed industry in Ukraine are established. The main problems of seed production development are identified and measures to stimulate selection activities in Ukraine are proposed. Prospects for the development of Ukrainian seed production are outlined. Conclusions, suggestions, and practical recommendations can be used in the development of national programmes to support seed production in Ukraine

► **Keywords:** seed production, selection activities, seeds and planting material, certified seeds, variety, royalty, import, export

► Introduction

Despite the fact that Ukraine is one of the largest exporters of grain and oilseeds, a significant volume of seeds on the domestic market is imported. The annual volume of seed imports amounts to USD 0.5 billion annually. The share of imported sunflower, rapeseed, and sugar beet seeds reaches 70-90% [1]. Imported seeds of agricultural crops displace Ukrainian varietal resources from the market of seeds and planting material, which negatively affects the seed industry of Ukraine [1].

Every year, national and foreign applicants submit from 1,000 to 2,000 applications for conducting a qualification examination of plant varieties. According to registration, about 1,500 plant varieties are received, of which about 70% are submitted by foreign applicants. At the end of 2020, 8,871 varieties and hybrids were included in the Register of Plant Varieties, of which 4,991 (56%) were varieties of foreign selection and 3,880 (44%) were varieties of national selection [2].

Now almost half of the varieties registered in

the State Register of Plant Varieties of Ukraine are of foreign origin [2]. At the same time, their share is growing, which in conditions of instability and new risks caused by the war poses a threat to the country's food security. Food security and seed safety are closely related, and danger in one area leads to uncertainty in the other [3].

Issues of seed industry development and problems providing the agricultural sector of the economy with seeds and planting materials were studied and covered by many prominent researchers.

D. Nabuuma, C. Reimers, K. Hoang, T. Stomph, J. Raneri studied the impact of seed system measures on food security in low- and middle-income countries. They believe that agricultural activities that promote food production and consumption often lack detailed information about seeds and other agricultural resources. Thus, there is limited evidence to which seeds and seed systems directly (or indirectly) contribute to improving food quality [4].

S. McGuire and L. Sperling justify the need for

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a sustainable seed system, which is key to ensuring food security. The seed system includes technologies, organisational measures, market and non-market institutions that provide access to the use of seeds [5].

The development of the seed production system provides for a set of measures to create new varieties of agricultural crops to meet the needs of agricultural enterprises. The seed production system includes plant selection, a programme for the development of each variety to provide agricultural producers with high-quality seeds.

S. Gairhe, K. Timsina, Yu. Ghimire, J. Lamichhane, S. Subedi, and J. Shrestha, analysing the system of production and distribution of corn seeds, concluded that the state should support farmers in the introduction of modern technologies, seeds of high-performance varieties, and other materials for commercial seed cultivation. Low access to finance for small farmers and other participants in the value chain is one of the main obstacles in the seed sector [6].

Pushpa Singh notes that there are global problems in the development of national seed production systems. Multinational companies have contributed to the concentration of the market and the spread of monopolies in the development of the seed production system, introducing high licensing fees and royalties, and controlling the world's food supply. This leads to overpaid farmers and can lead to environmentally destructive agricultural systems. Private companies that dominate the seed market are changing the goals and orientation of seed sector selection, creating a new dynamic that now controls the market. They focus their research on innovations in selection activities that would develop those properties in seeds that could bring them the highest market profit. This applies to the hybrid selection of more profitable crops, in particular, vegetable crops [7].

F. Solfanelli, E. Ozturk, S. Orsini, F. Schäfer and R. Zanolì considered it important to create European national databases of organic seeds, which would contain a list of varieties for which organically produced seeds and vegetative propagation material are available on the market. The creation of such databases can facilitate the use and distribution of organic seeds [8], which will contribute to the development of organic agriculture.

This study aims to identify the competitive advantages of the seed industry in Ukraine that characterise its development potential and the threats that give rise to additional risks. Based on the analysis of current trends in the functioning of the national seed production industry, prospects for its further development are determined.

► Materials and Methods

The study was conducted on the basis of statistical data of the State Statistics Service of Ukraine, performance indicators of research institutes, research stations, and agricultural enterprises of the National Academy of Agrarian Sciences, and the State Register of Plant Varieties suitable for distribution in Ukraine

and the Register of certificates for sowing and commercial qualities of seeds for 2021, provided by Ministry of Agrarian Policy and Food of Ukraine. In addition, information from Internet resources was used, in particular, expert assessments and reports on important events that significantly affect the development of national seed production.

The research was based on the use of the dialectical method, which involved the analysis of processes and phenomena in their development, interrelation, and interdependence. For a deeper understanding of the problems of the development of the seed industry in Ukraine, such general scientific research methods as observation, scientific cognition, analysis, synthesis, comparative analysis, and system generalisation were also used. For a more visual representation of information and presentation of statistical data and their correlations, and for a better perception and understanding of economic processes and phenomena, the study also uses a graphical method.

Using the methods of system analysis and scientific generalisation, current trends in the development of seed production in Ukraine were identified. In addition, a number of provisions have been formed and substantiated that reveal the content of the study and have theoretical and practical significance for the development of the national seed industry. For scientific substantiation of the existing competitive advantages of seed production in Ukraine, which form the potential of the industry, as well as the main problems and threats that cause additional risks and hinder its development, the study uses methods of system analysis and generalisation.

The calculation of the need for seeds and the volume of certified seeds of the main agricultural crops to ensure sowing in 2022 was carried out using statistical data from the Register of certificates for sowing and commercial qualities of seeds for 2021, the sown areas of the main agricultural crops, the level of their yield, and seeding rates per 1 ha. At the same time, the need to create appropriate reserve stocks of agricultural seeds was considered.

► Results and Discussion

Currently, the production of certified seeds of the main grain and oilseeds in Ukraine does not fully meet the needs of agricultural producers. Thus, in 2021, 359 thousand tonnes of breeder, basic, and certified seeds were produced, with the need for 2,500-3,000 thousand tonnes. The volume of certified seeds of basic grain and oilseeds of Ukrainian selection amounted to 123.2 thousand tonnes, or 34.3% of the total volume of certified seeds, and the volume of seeds of foreign selection imported from abroad, respectively – 54.3 thousand tonnes. At the same time, another 182.5 thousand tonnes of seeds of foreign selection were produced and certified on the territory of Ukraine. Thus, the total volume of production of certified seeds of foreign selection produced in Ukraine and imported in 2021 amounted to 235.8 thousand tonnes, or 65.7% [1].

The decrease in seed production of major agricultural crops of Ukrainian selection is a negative trend in recent years, which hinders the development of national seed production. In 2021, the production of grain seeds of Ukrainian selection amounted to 118.4 thousand tonnes against 156.6 thousand tonnes in 2020 [1]. At the same time, 170.8 thousand tonnes of foreign-selected seeds were imported and produced in Ukraine, which accounted for almost 60% of the total seed fund of grain crops [1]. Compared to the previous year the share of grain seeds of foreign selection increased by almost 10 points [1]. Against the background of a decrease in the production of seeds of Ukrainian selection, there is an increase in the production of seeds of foreign selection of

Ukrainian production and a reduction in the import of seeds [1].

A similar trend is also observed in the market of certified oilseeds (soybeans, sunflower, winter rape). In 2021, Ukraine produced only 4.8 thousand tonnes of seeds of national selection and 65.0 thousand tonnes of seeds of foreign selection against 6.2 thousand tonnes and 65.9 thousand tonnes in 2020, respectively [1]. The decrease in the production of seeds of Ukrainian selection was conditioned by a reduction in the production of soybean and sunflower seeds [1]. At the same time, the production of seeds of these crops of foreign selection also decreased. In general, the share of oilseeds of Ukrainian selection in 2021 was 6.9% against 8.6% in 2020 (Table 1) [1].

Table 1. Production of certified seeds of the main agricultural crops in Ukraine in 2021

Cultures	Seeds of Ukrainian selection, thousand tonnes	Seeds of foreign selection, thousand tonnes		Seeds of foreign selection, thousand tonnes	Total seeds produced, thousand tonnes	Share of seeds of Ukrainian selection, %
		Imported to Ukraine	Produced in Ukraine			
Winter wheat	75.9	1.5	43.5	45.0	120.9	62.8
Spring barley	9.4	0.2	11.7	11.9	21.3	44.1
Winter barley	9.7	0.2	10.5	10.7	20.4	47.5
Corn	22.2	19.9	77.1	97.0	119.2	18.6
Winter rye	1.2	1.2	5.0	6.2	7.4	16.2
Total cereals	118.4	23.0	147.8	170.8	289.2	40.9
Soybean	1.5	0.4	16.6	17.0	18.5	8.1
Winter rape	0.5	4.7	0.2	4.9	5.4	9.3
Sunflower	2.8	26.2	16.9	43.1	45.9	6.1
Total oilseeds	4.8	31.3	33.7	65.0	69.8	6.9
Total cereals and oilseeds	123.2	54.3	182.5	235.8	359.0	34.3
Potatoes	0.3	3.6	29.8	33.4	33.7	0.9
Sugar beet	0	0.8	0.3	1.1	1.1	0

Source: calculated by the authors based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

In Ukraine, the production of seeds of only certain agricultural crops ensures an appropriate level of food security. In particular, the production of buckwheat, millet, oats, and triticale is fully provided with seeds of Ukrainian selection. The level of provision of seeds of Ukrainian selection for winter

wheat growing is 62.8%, winter barley – 47.5%, spring barley – 44.1%, spring wheat, winter rye, corn, soybeans, sunflower, and peas – less than 40%. The average level of providing production of grain and oilseeds with seeds of Ukrainian selection is only 34.3% (Table 1; 2).

Table 2. Production of certified seeds of niche agricultural crops in Ukraine in 2021

Cultures	Seeds of Ukrainian selection, thousand tonnes	Seeds of foreign selection, thousand tonnes		Seeds of foreign selection, thousand tonnes	Total seeds produced, thousand tonnes	Share of seeds of Ukrainian selection, %
		imported to Ukraine	produced in Ukraine			
Buckwheat	0.6	0	0	0	0.6	100.0
Millet	1.1	0	0	0	1.1	100.0
Oat	1.2	0	0	0	1.2	100.0
Triticale	1.1	0	0	0	1.1	100.0
Spring wheat	2.4	0.1	5.8	5.9	8.3	28.9
Peas	2.2	0.5	4.5	5.0	7.2	30.6
Total niche crops	8.6	0.6	10.3	10.9	19.5	44.1

Source: calculated by the authors based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

Significant demand for foreign-selected planting material increases the level of import dependence of the domestic seed market and creates additional risks in the production of agricultural products, in particular, due to possible restrictions conditioned by the war or the introduction of quarantine measures in the context of the covid-19 pandemic. Every year Ukraine imports USD 400-500 million worth of seeds [9]. In addition, the state produces certified

seeds of foreign selection, financed by foreign companies, for almost the same amount – about USD 500 million [9]. At the same time, the share of the main agricultural crop seeds of Ukrainian selection decreases annually. In particular, the share of winter wheat seeds of Ukrainian selection in 2021 compared to 2020 decreased from 66.2% to 62.8%, spring barley – from 57.8% to 44.1%, corn seeds – from 29% to 18.6% (Fig. 1).



Figure 1. Share of seeds of major agricultural crops of Ukrainian selection

Source: compiled based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

Increased import dependence may lead to the decline of Ukrainian seed production and the complete displacement of Ukrainian varietal resources from the seed and planting material market, which will pose a threat to Ukraine's food security. Researchers and specialists of the agricultural sector reasonably believe that the variety provides an increase in yield and stability of agricultural production [10]. It is the variety and seeds, according to V.M. Sokolov, that are an important factor in the intensification of agricultural production, which significantly increases its economic efficiency [11].

The tendency to increase imports of seed material, which has been observed in Ukraine since 2015 and continued in 2021, is the result of increased demand due to an increase in its consumption by holding companies and large and medium-sized producers who have sufficient financial support [12]. In addition, quarantine restrictions in 2020-2021 gave an impetus to the development of foreign selection companies in Ukraine, including Syngenta SIDS, Maisadur Semans, Dow AgroSciences, Limagrain Europe, and the expansion of production of certified seeds of many agricultural crops to meet the needs of Ukrainian producers.

According to the decision of the European Parliament, the seed certification system that operates

in Ukraine has been recognised by the EU countries. Thus, Ukraine is included in the list of non-EU countries that have the right to export grain seeds such as oats, barley, rice, rye, wheat, triticale, corn, and sorghum to the European market [13]. Ukrainian seeds have gained access to the European market – one of the most attractive and at the same time the most protected markets in the world from foreign seeds. The world market sells seeds produced on the territory of Ukraine – both of Ukrainian selection and selection of foreign seed companies operating in Ukraine.

The seed market in Ukraine has a significant development potential. According to experts, most Ukrainian varieties and hybrids are not inferior in economic and biological characteristics to foreign ones, they are quite competitive, and foreign analogues often predominate in such characteristics as winter hardiness, drought resistance, disease resistance, and taste qualities [14].

The share of certified seeds to ensure the sowing of such important agricultural crops as winter wheat, winter barley, spring barley, soybeans in 2022 does not exceed 10%, which is explained by the use of varietal seeds for 5-7 years with a decrease in its quality. Hybrid corn, sunflower, and winter rapeseed crops are 100% provided with certified seeds due to their use only for one year (Table 3).

Table 3. Seed demand and volume of certified seeds of major agricultural crops to ensure sowing in 2022

	Sale of certified seeds, thousand tonnes	Farm Saved Seed, thousand tonnes	Seed requirement, total thousand tonnes	Share of certified seeds, %
Winter wheat	80.6	1,526.7	1,607.3	5.0
Winter barley	13.6	232.4	246.0	5.5
Spring barley	14.2	287.2	301.4	4.7
Winter rye	4.9	25.2	30.1	16.4
Corn	110.0	0	110.0	100.0
Soybean	12.3	163.3	175.6	7.0
Winter rape	4.5	0	4.5	100.0
Sunflower	45.2	0	45.2	100.0

Source: calculated by the authors based on data of the Ministry of Agrarian Policy and Food of Ukraine [1]

Increasing the level of competitiveness of national seed production requires the popularisation of national varieties and hybrids that have significant yield potential, high quality indicators, and are resistant to climate change and environmental stress for their wider use by agricultural producers. According to experts, it is possible to achieve an increase in yield by 20-30% only at the expense of the variety. This is the cheapest lever of influence on stabilising production and increasing crop yields, especially in the current conditions [15].

The development of national seed production in the future will primarily depend on an objective assessment of the market value of each variety, and, accordingly, the payment for its growth [16]. The organisation of the system for collecting selection fees should be developed considering world experience. If a similar system is not applied in Ukraine in the near future, this may lead to a loss of priorities, a chronic lag in the selection industry, and the dominance of foreign varieties.

In addition to the need to introduce a system of royalties and fees in Ukraine, which is an important measure to support and protect the interests of plant breeders, the priority should be to ensure appropriate funding for selection centres and scientific institutions of the appropriate profile.

Currently, state support for Ukrainian selection is completely absent. National programmes for financing selection in crop production were in effect until 2011. In 2018 and 2019, financial support for agricultural producers was provided in the form of "partial compensation for the cost of seeds of agricultural plants of Ukrainian selection purchased from seed production facilities", but then it was cancelled [17; 18].

O.V. Shubravska draws attention to the fact that the deplorable state of selection activity is also a consequence of the presence of a complex of problems in the field of Ukrainian science and education (in particular, it is recognised that Ukrainian agricultural science has lagged behind foreign science by 20-30 years, and scientific discoveries and breakthroughs of Ukrainian researchers remain on experimental sites and in the walls of offices). However, despite the identification of these problems, there

are no effective mechanisms for solving them, which only worsens the current situation [19].

For the effective functioning of the National Seed Production System, it is necessary to conduct scientific and technical expertise of crop varieties, which is characterised by high cost-efficiency. However, institutions of expertise cannot ensure not only the development, but also the preservation of the resources and facilities and the corresponding reimbursement of their own expenses. Therefore, It is necessary to ensure that the costs of scientific and technical evaluation of plant varieties are financed from the state budget at the level of their normative need [20].

In this regard, it is important to involve all interested parties, namely: the state, selectionists, seed producers, researchers, and other specialists. Among the priorities: improvement of the legal standards of any royalty in Ukraine considering the positive experience of the EU countries and other leading countries of the world; compulsory declaration of varietal production crops agricultural producers, who are the owners of agricultural land with an area of 25 ha or more (for potatoes – from 10 ha); development of an effective mechanism to receive royalties based on real reflection of the seed and planting material using the license and sublicense agreement, and selection fees for Farm Saved Seed (FSS) – the seeds for their own use, and registration of an independent body of accounting supervision and control; enhance the role of professional associations in terms of registration of license agreements and royalty payments, as well as monitoring, recording, and compiling the base of the seed and commodity crops in varieties and hybrids; increase the receipt of funds for the payment of royalties and payments breeding for the production of new highly productive and high quality varieties of the national selection; introduction of proof of payment of royalty and/or payments for FSS as a condition of state support for the reimbursement of the cost of seed/ planting material of national selection; development and implementation of state protectionist measures for the protection of the Ukrainian market of seeds from foreign domination; introduction of state support for the Ukrainian seed production and breeding in

the national market due to the action of selection and seed programmes; identification of further measures to improve the quality of Ukrainian seeds, especially hybrid, where Ukrainian breeding noticeably inferior to foreign ones; development and implementation of effective mechanisms to combat the adulteration of seeds in the Ukrainian market; creation of the national programme for the development of Ukrainian breeding and seed production.

► Conclusions

The seed production system plays a leading role in the development of farming industry and is an important condition for ensuring national food security. The production of seeds of national selection should be a priority area for the development of the seed production system, which will help to increase the level of competitiveness of the seed industry.

In the process of creating the seed production system, there is a tendency to increase the share of seeds of foreign selection. The growth of import dependence on the seed market in Ukraine negatively affects the level of food security and hinders the development of selection activities. In addition, insufficient funding for national selection can lead to the minimisation of the presence of Ukrainian varietal resources on the seed and planting material market.

Moreover, imperfect legal regulation of economic relations in selection activities negatively affects the

efficiency of Ukrainian selection, reduces the supply of high-quality and high-yielding seeds of new varieties and hybrids on the market, which causes additional risks for crop-growing agricultural sectors.

At the same time, the national seed industry has a fairly strong potential for its development. A significant share of Ukrainian varieties and hybrids in terms of individual characteristics and properties even prevail over foreign analogues. Therefore, it is important to popularise national competitive varieties and hybrids in order to spread them more widely.

It is necessary to provide sufficient funding for research institutions and selection centres to create new highly productive varieties and hybrids. It is also important to increase the level of training of specialists in the seed industry and support them in the process of selection activities.

In the state programme for the development of Ukrainian selection and seed production, it is necessary to provide: full reimbursement of the costs of carrying out work on the selection of agricultural crops in the links of primary seed production; partial compensation for the costs of seed production of primary links, state support for the development of the resources and facilities of selection and seed production, improving the activities of selection and seed production complexes; covering the share of costs associated with scientific research.

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Перспективи розвитку насіннєвої галузі України

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► **Анотація.** Враховуючи значний потенціал виробництва та експорту сільськогосподарської продукції галузей рослинництва в Україні, важливим є розвиток ефективної національної системи насінництва. Забезпечення сільськогосподарських товаровиробників насінням національної селекції є одним із основних факторів продовольчої безпеки країни. Формування ефективної системи насінництва передбачає створення відповідних умов для збільшення виробництва насіння та популяризації національних сортів і гібридів, які мають значний потенціал урожайності та високі показники якості для більш широкого їх використання, що забезпечить конкурентні переваги сільськогосподарського виробництва та його розвиток. Мета статті – встановити тенденції та окреслити перспективи розвитку насіннєвої галузі України. У процесі дослідження використано діалектичний метод наукового пізнання, аналізу й синтезу, системного узагальнення (встановлення тенденцій розвитку української насіннєвої галузі; формування висновків), порівняльного аналізу (визначення основних проблем розвитку насінництва в Україні). Встановлено тенденції розвитку української насіннєвої галузі. Виявлено основні проблеми розвитку насінництва та запропоновано заходи щодо стимулювання селекційної діяльності в Україні. Окреслено перспективи розвитку українського насінництва. Запропоновано заходи щодо стимулювання розвитку насіннєвої галузі в Україні. Висновки, пропозиції та практичні рекомендації можуть бути використані під час розробки національних програм підтримки насінництва в Україні

► **Ключові слова:** насінництво, селекційна діяльність, насіння і садивний матеріал, кондиційне насіння, сорт, роялті, імпорт, експорт



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Competitiveness in the Horticultural Market of Ukraine

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► **Abstract.** Competitiveness generally characterises the relative advantages in the market according to various quantitative and qualitative criteria and ultimately affects the development of its market conditions and the overall food supply of the population. Therefore, the study of competitiveness in the horticultural market in terms of production and sales volumes, prices, quality, and pomological varieties is quite important. The establishment of relative indicators of competitive advantages in the fruit and berry market determines favourable positions by various operators of economic relations. The purpose of the study consists in determining competitiveness in the fruit and berry market using relative indicators for comparing preferences in terms of the volume of the supply of fruits and berries by different categories of farms, prices, and pomological varieties. The research was guided by methodological approaches to determining the competitiveness of agricultural products in the Ukrainian agricultural market. At the same time, the following methods were used: dialectical method of cognition of market processes and a systematic approach, analytical generalisations, statistical comparison, constructive and computational, abstract and logical method. Based on comparative indicators of competitiveness of horticultural products in the Ukrainian market, the level of market competition of agricultural enterprises and households is estimated: the coefficient of market competition and the Herfindahl-Hirschman Index of market concentration. It is established that according to the first level of concentration of the industrial sector, the Ukrainian fruit market is in the low concentration group. Another indicator defined for households indicates a low concentration, high competition, a sufficient number of operators, and a weak position of each of them. In terms of fruit and berry production, Ukrainian producers are more competitive than importers. In terms of prices, agricultural producers and importers had competitive advantages. Competitive pomological varieties of fruits and berries for producers, traders, and consumers are determined based on calculations of competitive advantages and author's study of the trade and consumer sectors. The competitiveness of various categories of farms in the horticultural market, competitive advantages in terms of production volumes, prices, and pomological varieties of fruits and berries are determined from the standpoint of the need to rationally provide the needs of the population with high-quality food products and further market development. The findings should be used in the creation of a target programme for the development of the food market for a long-term period aimed primarily at the rational provision of food products competitive in price and quality to the population of Ukraine

► **Keywords:** horticultural products; production by category of farms; import supplies; consumer price; pomological variety

► Introduction

The state of development of the Ukrainian fruit and berry market is characterised, first of all, by the degree of satisfaction of the needs of the population with these products with appropriate quality and price availability. Market parameters of competitive advantages that characterise horticultural products are divided into those that relate to its consumer properties and those that determine its economic properties. The former, in turn, are divided into hard (parameters of compliance with international or national standards and regulations) and soft (aesthetic properties, design, colour, packaging). These

parameters are considered the key point in analysing the competitiveness of fruits and berries. Therefore, the study of competitiveness in the horticultural market in terms of production and sales volumes, prices, quality, and pomological varieties is quite important. After all, the areas of development of the fruit and berry market have been somewhat transformed – in addition to increasing the requirements for the supply and trade in products, there is a need to improve foreign trade relations. This is especially relevant considering the association between Ukraine and the European Union, due to the need to more actively

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introduce world standards of product quality and safety into production, when the issue of the country's export potential and its share in the world food market came to the fore.

Problems of production, consumption, and competitiveness in the Ukrainian food market were considered by V.T. Dudar and T.H. Dudar [1], N.Ye. Holomsha and O.Ya. Golomsha [2], O.Ya. Dzyadikevich and N.Ye. Holomsha [3], M.V. Misiuk [4], O.M. Yatsenko [5], et al. Theoretical and practical economic research in horticulture, which served as the basis for solving the problems of developing a competitive Ukrainian fruit and berry market, was carried out by O.Yu. Ermakov [6], L.O. Barabash [6], T.A. Markina [6], V.A. Ruliev [6], G.M. Satina [6], A.M. Shestopal [6] et al. I.V. Kolokolchikova was engaged in research on segmentation of the market of the horticultural products, determining the components and principles of this process [7]. Actual practical problems of horticultural market development, and monitoring the level of consumption of industry products were studied by Yu.V. Kernasiuk [8], T.P. Lozova [9], O.V. Nikishina [10] were engaged in the study of current trends and problems in the logistics development of the market of the horticultural products in Ukraine.

Mechanisms of influence of state financial support on the state and trends in the development of competitiveness of the horticultural industry in Ukraine have been thoroughly studied by L.M. Galat [11]. The study and systematisation of intensification factors and their impact on improving the competitiveness of horticultural enterprises was investigated by O.S. Tupchiy [12]. Prospects of innovation and investment competitive development of the horticultural industry in the regions of Ukraine were explored by O.V. Cherevko, I.A. Franiv [13].

Competitiveness in the food market was also covered by R. Sergeev [14], A. Adukova [15], A. Redkva [16], K. Shatnenko [17], and the authors of this study [18]. However, certain aspects of competitiveness in the Ukrainian horticultural market, both in general and in the context of crops, require additional, more thorough investigation. *The purpose of the study* – monitoring and diagnostics of the level of competitiveness in the market of fruit and berry products by means of relative indicators comparing advantages in terms of production volumes by agricultural enterprises and household farms, prices, and pomological varieties.

► Materials and Methods

In the course of the research, the following methods were used: dialectical method of cognition of market processes and a systematic approach (to investigate the problems that arise in the production, establishment of product supply, and sale of products); analytical generalisations, statistical comparison, calculation (for generalisation, analysis and evaluation of market indicators), tabular (to illustrate research results), abstract and logical method (for conclusions).

The research is based on methodological approaches to determining the competitiveness of

agricultural products in the Ukrainian agricultural market. The market concentration index, four-part concentration index, Herfindahl index, Herfindahl-Hirschman index, Rosenbluth index, Hall-Tyldman index, and relative concentration ratio are the most commonly used to investigate the competitive situation in the fruit market. The use of these indicators allows assessing the distribution of market shares between competitors and determining the intensity of competition, the degree of monopolisation, and the degree of concentration of the product market under study.

The market competition coefficient (GR) and the Herfindel-Hirschman Index (HH_i) [4, p. 100] (1; 2) have been applied and adapted to the specifics of the fruit and berry market in order to achieve the research objective.

$$GR = \frac{\sum_{i=1}^n V_i}{V_m} * 100\% \quad (1)$$

where V_i – volumes of fruit supplies by individual i -th commodity producer; V_m – total volume of fruits sold on the market (market capacity); n – the number of producers operating within the fruit market.

$$HH_i = \sum_{i=1}^n D_i^2 \quad (2)$$

where D_i – share of the business entity in the fruit market; n – the number of entities engaged in trading activities within the fruit market.

The first indicator characterises the share of an individual producer operating within the fruit market in the total volume of their sales (market capacity). The latter shows the level of concentration in the market of a particular commodity producer.

A market share is a traditional tool that can be used to assess the effectiveness of a horticultural producer, and to predict further prospects for its development. This indicator clearly interprets its rating place in the corresponding market segment relative to its competitors. It is established that a quantitative reflection of market share can be obtained by calculating the percentage ratio of sales volume to total sales indicators of products belonging to the same group. The market share reflects how effective the company's marketing activities are. The share of a particular producer can be calculated not only for the market, but also for a particular segment.

In the course of the study, a differentiated methodological mechanism for monitoring and diagnosing the competitiveness of industrial horticultural producers is proposed by calculating and analysing market competition coefficients, and for households – using the Herfindahl-Hirschman Index of market concentration.

In turn, the tools allow for the determination of relative indicators that diagnose the level of competition in the horticultural market, without having precise data for each small producer. At the same time the accuracy and correctness of the coefficient calculations are not lost.

► Results and Discussion

It is important to use relative indicators when assessing the competitiveness of agricultural products. They are also used to establish cross-industry competitiveness. Foreign researchers recommend assessing the competitiveness of agricultural products at the micro and macro levels: products, enterprises, industries, and nationwide [19-21]. Of particular importance in determining competitiveness in the Ukrainian market of fruits and berries is the establishment of competitive advantages of commodity producers in terms of production and sales volumes.

In recent years, researchers investigated the development of the Ukrainian and global market of horticultural products, pricing, insurance, lending, the development of Ukrainian horticulture based on greening and resource conservation, horticultural

production on an innovative basis, made a forecast of market conditions considering WTO requirements, etc. However, the tools for assessing market competitiveness by relative parameters proposed by the authors are carried out for the first time from the standpoint of adaptation to modern economic conditions of the horticultural market operation.

By GR and HH_I indicators the Ukrainian fruit market can be classified into one of three types: highly concentrated ($70\% < GR < 100\%$; $2,000 < HH_I < 10,000$), moderately concentrated ($45\% < GR < 70\%$; $1,000 < HH_I < 2,000$), and low-concentrated ($GR < 45\%$; $HH_I < 1,000$) [1, p. 101; 4].

GR is used to characterise the level of competitive advantages of the industrial sector in the Ukrainian horticultural market, and households can use HH_I (Table 1).

Table 1. Indicators of market competition of all categories of farms on the Ukrainian horticultural market

Products	Years				
	2016	2017	2018	2019	2020
GR coefficients for the industrial sector					
Fruits incl.	27.3	23.2	31.7	22.2	22.4
Pome fruits	53.8	44.5	65.4	45.5	53.6
Stone fruits	21.1	11.1	21.3	18.7	16.4
HH_I indicators for households					
Fruits incl.	660	759	700	668	775
Pome fruits	1,545	1,693	1,811	1,704	2,685
Stone fruits	3,534	1,563	2,855	4,299	3,741

Source: calculated based on the authors' research and data from the State Statistics Service of Ukraine [22]

The main producers of fruits and berries in Ukraine are private households – 83-85%. Among agricultural enterprises, the bulk of fruits and berries are grown and sold by non-state-owned farms. Thus, the production of private farms is expanding – in 2020, the volumes amounted to 90.8 thousand tonnes, or 27% of the gross profit of the industrial sector [22].

The GR coefficient during 2016-2020 in general for fruits and, in particular, for stone fruits did not exceed 45% – it was 22.2-31.7% and 11.1-21.3%, respectively. Therefore, according to the level of concentration of the industrial sector, the Ukrainian fruit market should be attributed to the last group – low-concentrated markets. The best situation is observed for the pome crops. The GR coefficient is 44.5-53.8%, which indicates a moderate concentration of this area of activity of agricultural enterprises. Among other fruits, most of all pome fruits are produced in Ukraine – up to 70% (1.3 million tonnes).

Herfindahl-Hirschmann Index (HH_I) of market concentration for all types of fruits less than 1,000 – 660-775, which indicates a low concentration and

high competition in the Ukrainian fruit market, the presence of a sufficient number of economic entities and the relatively weak position of some of them. For fruits of pome crops, this indicator during 2016-2019 was close to 2,000 – it was 1,545-1,811, which causes an increased level of concentration with the possibility of switching to high. In 2020, it exceeded 2,000 by 685 units, which allows classifying the Ukrainian market of pome fruits as “highly concentrated” in terms of the availability of suppliers – private farms. The market for stone fruit crops, with the exception of 2017, was highly concentrated. Thus, private farms, among other categories of farms in Ukraine, are the main producers of pome and stone fruits – in 2020, 76% (9.6 million tonnes) and 97% (0.7 million tonnes), respectively.

In the horticultural market, Ukrainian producers are more competitive in terms of production volumes compared to importers (Fig. 1). On average, in 2016-2020, the country produced 53 times more pome fruits (1,351 thousand tonnes), 13 times more stone fruits (555 thousand tons), 2 times more berries (131 thousand tonnes) and 17 times more nuts (116 thousand tonnes) compared to imported fruits [22].

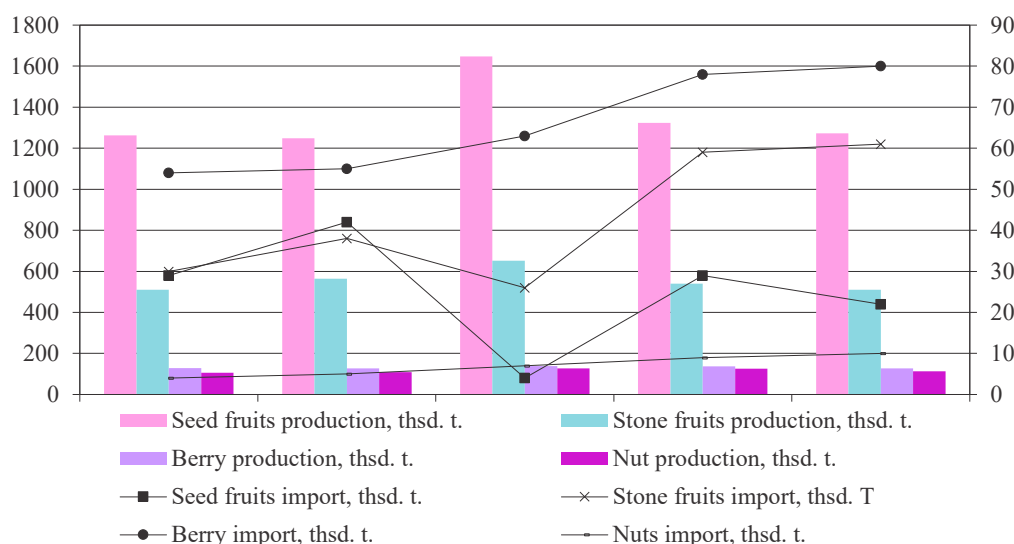


Figure 1. Dynamics of Ukrainian production and imports of fruits and berries, thousand tonnes

Source: compiled according to the data from the State Statistics Service of Ukraine [22]

To fully assess the economic parameters of the competitiveness of fruit products, it is also worth comparing the sales prices of suppliers to the Ukrainian market – agricultural enterprises, private farms, and

importers, for example, for apples (Table 2). Ultimately, their production volume is 55% or 1,114.6 thousand tonnes (in 2020) of the total production of horticultural crops in the country [22].

Table 2. Average consumer sales prices of apples in Ukraine, UAH/kg

Indicators	2016	2017	Years 2018	2019	2020	2020 in % to 2016
Sales price of agricultural enterprises	12.00	16.50	16.00	13.50	22.50	187.5
Sells price by households	15.00	18.00	18.00	15.00	25.00	166.7
Price of imported apples	12.85	11.80	26.40	13.30	22.45	174.7

Source: calculated based on the authors' research and data from the State Statistics Service of Ukraine [22; 23]

Annual average consumer sales prices by agricultural enterprises in 2016-2020 amounted to 12.00-22.50 UAH/kg, which is 1.1-1.3 times less than the prices of households. The importer prices (with the exception of 2018) did not differ significantly. In 2019-2020, agricultural enterprises and importers had competitive advantages in terms of prices. This was conditioned by the fact that each individual subsidiary farm has a small mass of apples for sale, and therefore, can sell them in the same period as agricultural enterprises or importers and at higher prices. In addition, a psychological factor is triggered – consumers mostly believe that fruit cultivation by the population is organic, and therefore, cannot harm their health, which is why they are willing to buy products sometimes at much higher prices.

There is competition between producers for an advantage in price and quality, and the task is put at the forefront – to reduce the cost of production and marketing of horticultural products and at the same time improve their quality. The commercial quality of fruits and berries depends not only on the level of consumption, but also on varietal characteristics, meteorological conditions, areas and growing conditions, on appropriate preliminary preparation – sorting by quantity, size, packaging, etc. As a rule, commercial quality is determined by external signs:

size, colour, shape, degree of damage by diseases or mechanical devices [6].

The formation of yield, quality, and shelf life of horticultural products, in addition to the human factor, is significantly influenced by weather and climatic conditions. Thus, more than 60% of the risks that affect the productivity of perennial plantings are caused by the latter, which are closely related to global warming. Thus, in Ukraine, crop losses from adverse weather conditions, in some years, can reach 45-50%, and when they are combined, 70% or more [24, p. 67]. Most often, cases of loss of horticultural crops occur due to frost and drought.

In circumstances where there are a significant number of producers and intermediaries in the Ukrainian horticultural market, which leads to price competition between them, it is important to focus on the development of consumer demand. One of its features is the consumer's preference for a particular pomological variety. This has a direct impact on the price. For example, according to the author's observations of the price situation on the Demiyivskyi market in Kyiv in 2020, apples of the winter Ligol variety were almost 40% more expensive than the Djonared variety and 6% more expensive than Florina [25]. The monitoring of pomological varieties of horticultural crops was also carried out in the previous

2004-2013 years. There was a significant differentiation of prices for different types of fruits and vegetables depending on the variety, primarily due to consumer preferences, taste, appearance, shelf life, transportability, supply volumes, etc. [26]. The price level for a particular variety is largely determined by the stage of its life cycle. Newer, more advanced varieties tend to have a higher market value, and conversely, older varieties are inferior to them in the market over time. As with any product, the life cycle of pomological varieties of fruits and berries consists of the following stages: the development of the variety, its introduction into commodity production, stabilisation of production volumes, reduction of use and displacement of the variety from the market. The effectiveness of horticultural market operators is largely determined by the ability to correctly and quickly respond to consumer requests regarding the pomological characteristics of the product.

Regular determination of the rating table of pomological varieties to compare their competitiveness should be carried out at the following stages:

1. Identification of the main criteria of commodity quality for individual market entities (manufacturers, wholesalers, consumers).
2. Evaluation of quality indicators of pomological varieties in points.
3. Calculation of intermediate competitiveness coefficients (for individual market operators) and the general one.
4. Determination of the most competitive pomological varieties according to the scale: coefficient above 0.5 – competitiveness is satisfactory; close to

1.0 – good; above 1.0 – excellent). For certain varieties of fruit and berry crops, the composition of assessment indicators differs due to their biological and technological features. For example, for black currants, the length of the bunch and the number of berries in it are important at the first stage; for raspberries, the adhesion to the fruit, resistance to rotting, the shape of the berry, etc. However, the most important among the indicators is considered to be yield.

At the second stage of calculating the competitiveness of varieties, in accordance with previously substantiated criteria, quality indicators obtained based on the results of variety testing are selected. The latter are characterised by a nine-point rating system.

At the third stage, the intermediate and general coefficients of competitiveness of the variety are calculated. They are a comparative assessment of the pomological qualities and market values of the variety in relation to the indicators of the control variety.

Using a step-by-step algorithm, it was found that the most competitive for the producer, trader, and consumer are strawberry varieties: Olvia, Prysviata, Ret Gontlet; black currant: Dochka Vorskly, Sofiivska, Cheresheva; remontant raspberry varieties: Polka, Herakl, Porana rosa, and among the early-late ripening period: Patricia, Persey. As an example, the indicators of competitiveness of pomological varieties in the black currant market are given (Fig. 2). The assessment was carried out for 15 varieties of Ukrainian selection. They were compared with the control variety Yuvileyna Kopania.

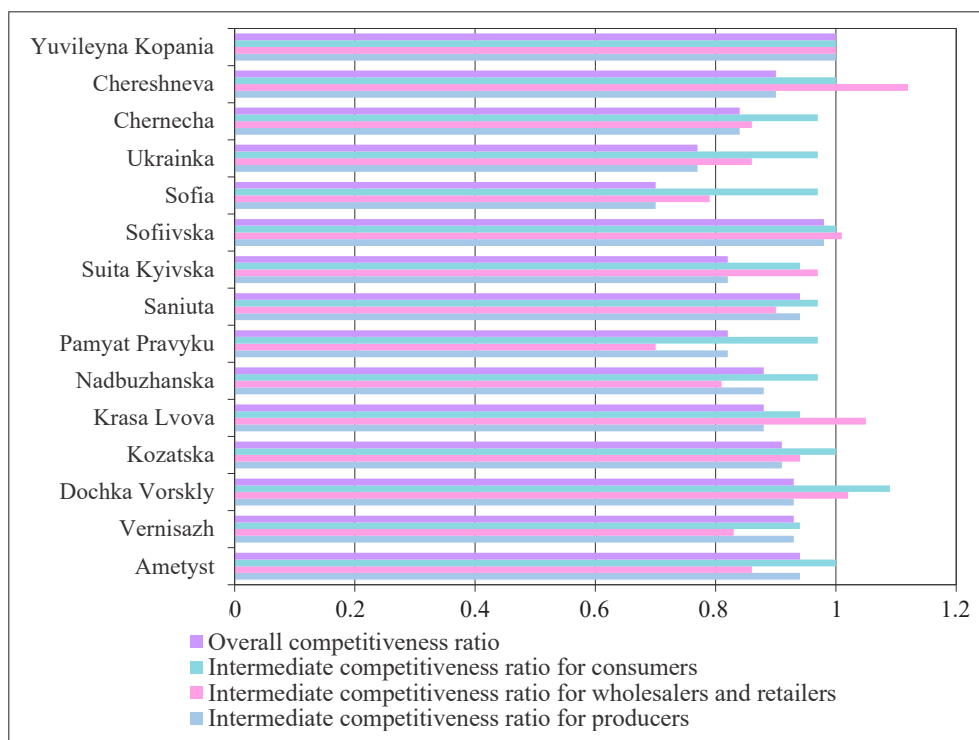


Figure 2. Competitiveness of pomological varieties on the Ukrainian black currant market

Source: calculated based on the results of research

According to a preliminary investigation, it was established that in Ukraine, competitive advantages are provided by the population, first of all, by products of Ukrainian origin [26]. Consumers often experiment when choosing pomological varieties. Among the summer varieties of apples, Papirovka and Melba had competitive advantages, autumn – Slava Peremozhstsiam, Antonovka, Mackintosh, Spartan, winter – Golden Delicious, Renet Simirenko (light colours), Idared, Champion, Gorets, Ligol, Richard. Among the pears, the most popular are Uliublennia Klappa, Bere Kyivska, Parizhanka, apricot – Krasnoschokyi, black cherry – Prysadybna, Nizhnist, Valeryi Chkalov, cherry – Turgenivska, Podbelskaya, plum – Stenley, Uhorka, Renklod Altana.

In general, it is noted that for consumers of fruits and berries, when making a purchase, the main criteria for choosing a pomological variety are appearance and organoleptic indicators, in particular, taste [26].

Therefore, all the quality criteria of pomological varieties are important for the producer. Assessment of their competitiveness should be carried out by individual regions of the country, considering environmental and natural features.

► Conclusions

According to the level of competitive advantages and concentration of all categories of farms, the fruit market of Ukraine is classified as low-concentrated. In terms of prices, Ukrainian fruits, in comparison with imported ones, turned out to be more competitive. Ukrainian producers occupy dominant positions in

the formation of the overall supply. It is determined that horticultural crops produced in Ukraine are in greater demand by consumers than imported ones. After all, they are marked by a lower content of chemical residues and are not inferior in organoleptic parameters. Therefore, there is reason to believe that in the national market, horticultural products will not lose their competitive position in terms of quality. Based on the study and step-by-step determination of the rating of pomological varieties, intermediate and general indicators of competitiveness, their competitive advantages for all operators of the horticultural market are established. The level of fruit and berry production by households occupies the main share, and their level of productivity is significantly ahead of industrial enterprises, which already indicates the significant potential of this category of farms in the future. It is worth noting that such development takes place almost without any significant state support, attracting additional labour resources or any special incentives.

However, to fully meet the needs of consumers with fruits and berries throughout the year, there is a need for appropriate legislative regulation on the creation of service cooperatives that would carry out wholesale purchases of products from the population during mass fruiting and, by agreement, continue to sell them through a wholesale or retail network. This would allow legalising the flow of fruits and berries, control their entry into the market of appropriate quality, introduce sorting and packaging, contribute to transparent price formation, and increase household incomes.

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Конкурентоспроможність на плодоягідному ринку України

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► **Анотація.** Конкурентоспроможність в загальному характеризує відносні переваги на ринку за різними кількісними та якісними критеріями і в кінцевому підсумку впливає на формування його кон'юнктури та цілому продовольчого забезпечення населення. Відтак дослідження конкурентоспроможності на плодоягідному ринку за обсягами виробництва і реалізації, цінами, якістю та помологічними сортами є досить важливими. Встановлення відносних показників, що показують конкурентні переваги на ринку плодів і ягід, уможливають визначення вигідних позицій різними операторами економічних відносин. Мета статті полягає у визначенні конкурентоспроможності на плодоягідному ринку за допомогою відносних показників порівняння переваг за обсягами формування пропозиції плодів і ягід різними категоріями господарств, цінами, помологічними сортами. У дослідженнях керувалися методичними підходами з визначення конкурентоспроможності сільськогосподарської продукції на українському аграрному ринку. При цьому використовувалися: діалектичний метод пізнання ринкових процесів та системний підхід, аналітичних узагальнень, статистичного порівняння, конструктивно-розрахунковий, абстрактно-логічний метод. На основі порівняльних показників конкурентоспроможності плодоягідної продукції на українському ринку, оцінено рівень ринкової конкуренції агроформувань та господарств населення: коефіцієнту ринкової конкуренції та індексу ринкової концентрації Герфінделя-Гіршмана. Встановлено, що відповідно до першого – за рівнем концентрації промислового сектору, український ринок плодів знаходиться у групі низькоконцентрованих. Інший показник, визначений для господарств населення, свідчить про низьку концентрацію, високу конкуренцію, достатню кількість операторів і слабку позицію окремого з них. За обсягами виробництва плодів і ягід українські виробники є більш конкурентоспроможними за імпортерів. За цінами – конкурентні переваги мали сільськогосподарські виробники та імпортери. Визначено конкурентоспроможні помологічні сорти плодів і ягід для виробників, торговців та споживачів на основі розрахунків конкурентних переваг та авторських досліджень торгівельного і споживчого секторів. Визначено конкурентоспроможність різних категорій господарств на плодоягідному ринку, конкурентні переваги за обсягами виробництва, цінами та помологічними сортами плодів і ягід з позиції необхідності раціонального забезпечення потреб населення якісними продуктами харчування та подальшого поступу ринку. Результати досліджень варто використовувати під час формування цільової програми розвитку продовольчого ринку на довгостроковий період спрямованої, насамперед, на раціональне забезпечення населення України конкурентоспроможними за ціною та якістю продуктами харчування

► **Ключові слова:** плодоягідна продукція, виробництво за категоріями господарств, імпорتنі поставки, споживча ціна; помологічний сорт



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Functioning of the Fish and Seafood Market in Ukraine

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► **Abstract.** Ukraine is one of the states that, to a large extent, meet their own needs for various crop and livestock products. At the same time, the capabilities of our agricultural sector allow forming an offer in an amount sufficient for profitable supplies to other countries. Therefore, when considering in detail the functioning of most agri-food markets in Ukraine, production and export are mainly described as the main structural elements of the balance sheet. In the case of the fish and seafood market, a completely different picture is observed, when the indicators and features of import and consumption come to the fore. The problem of import dependence in this segment only increases over time, caused by a combination of objective and subjective factors of an economic, social, and political nature. It is important from a scientific standpoint in this context to compare individual indicators of the world and Ukrainian fish and seafood markets to demonstrate the reasons for the different levels of their development at the present stage. The need to consider these and other related issues indicates the relevance of this topic. The purpose of the study is to investigate the situation on the Ukrainian fish and seafood market, the importance of its import for the generation of domestic supply and demand, to determine the potential of production in Ukraine at the expense of its own specialised industries. The following methods are used: theoretical generalisation, analysis and synthesis, comparative evaluation, historical, graphical, and tabular. The dynamics of import to Ukraine of products of group 3 of the UKTZED "Fish, crustaceans, mollusks" in quantitative and cost indicators, the general balance of these products, changes in its production by Ukrainian enterprises together with the key reasons, a detailed description of quantitative and qualitative indicators of the global market for these products, in particular, with the selection of leading countries in production, exports, consumption trends, assessed the prospects for its development, established a focus on the systemic development of the world market of fish and seafood in the context of movement of goods from primary producer to the final consumer, provided proposals for Ukrainian market to increase own production through legalisation and stimulation of aquaculture. The provisions of the study are aimed at informing Ukrainian industry enterprises, potential producers, and responsible state authorities about current trends in the global fish and seafood market to identify the potential of domestic production and reduce Ukraine's dependence on imports of this group of products

► **Keywords:** import dependence, domestic demand, fish and seafood, production potential, aquaculture

► Introduction

Recently, Ukraine has managed to significantly increase the volume of exports of agri-food products, while simultaneously increasing the value of the positive balance of foreign trade in them. Thus, Ukrainian exports increased from USD 14.6 billion in 2015 to USD 27.7 billion in 2021, the positive balance for this period increased from USD 11.1 billion to USD 20.0 billion [1; 2]. This contributed to the further establishment of Ukraine as a serious player in the global agricultural market. However, Ukraine's deeper involvement in the system of international integration processes and the global food market has led to an increase in the role of import supplies, in particular in relation to certain products. In addition, due to the ongoing decline in the

already insufficient production of aquatic biore-sources, Ukrainian agriculture, fisheries, and the processing industry cannot fully meet the needs of consumers in the domestic market on their own; a number of important items in this regard are forced to be imported. One of them is product group 3 of the UKTZED "Fish, crustaceans, mollusks", purchases of which abroad are crucial for the domestic market of Ukraine. Since these products are included in the list of main ones for which self-sufficiency and import dependence are given and calculated [3], it is important to better understand the commodity structure of purchases, their cost volumes, and the geographical diversification of supplies from abroad. Considering the fact that part of the specified assortment,

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namely, fresh freshwater fish, some types of marine fish, crustaceans, and mollusks are produced and extracted in Ukraine, it is advisable to consider the objective possibilities of the Ukrainian fishing industry and aquaculture in terms of reducing import dependence.

The characteristics of the functioning of various food markets within the country, region, and world were considered by Ukrainian researchers, in particular Yu.O. Lupenko [4], M.I. Puhachov [4; 5], O.G. Shpykuliak [5], O.V. Khodakivska [5]. The scientific aspect of the Ukrainian fish market from the standpoint of its problems and prospects is covered in research papers by Ukrainian scientists [6; 7]. Objective prerequisites for the practical development of aquaculture in Ukraine are given in the specialised literature [8]. Official statistical information of State Services shows the volume of fish and seafood imports to Ukraine and their role in shaping the balance of the domestic market [1-3]. The general overview of the Ukrainian market pays much more attention to the state and problems of industrial production [9; 10]. Current trends in consumption on the world market and the reasons for non-compliance with them on the Ukrainian market are reflected in popular scientific publications of Ukrainian experts [11-13]. International statistical databases help determine the quantitative and cost capacity of the global fish and seafood market, including its forecasts [14-16]. Separate narrow thematic reports focus on the importance of freshwater fish for the overall species diversity and the need to prevent the extinction of many representatives of this group [17].

Fundamental differences and key standards of the Ukrainian fish and seafood market are identified in comparison with the indicators of global production, consumption, and trade, including environmental care and the latest changes conditioned by the coronavirus pandemic. *The purpose of the study* is to consider the functioning of the fish and seafood market of Ukraine at the present stage, the current ratio of its own and imported products, to explore the possibilities of developing and increasing production by the fishing industry.

► Materials and Methods

In the process of researching the Ukrainian fish and seafood market, the following methods were used: theoretical generalisation – for the basic characteristics of the functioning of the domestic fish and seafood market of Ukraine at the present stage; analysis and synthesis – for the investigation of current trends in the world market of this product with a focus on its commodity and geographical structure, paying attention to the distribution of natural and artificial cultivation; comparative assessment – for the identification of the most statistically significant differences in the dynamics of indicators of the Ukrainian and world market; historical – for the assessment of

the extraction of aquatic bioresources in Ukraine at the end of the 20th century and the catch yield of wild fish in the world at the beginning of the 21st century; graphic and tabular – for the optimisation of the display of statistical and calculated results. Structurally, the study consists of three main stages: 1. Characteristics of the Ukrainian fish and seafood market – the commodity and geographical structure of their imports with prices for the most typical products of this group, the balance of fish and fish products, and the dynamics of obtaining aquatic bioresources in times of independence are considered. 2. Current trends of the world fish and seafood market – statistical data on the growth of quantitative volumes of production of this product are given, the ranking of its general export profitability in comparison with other types of food, achievement in general of the optimum balance between wild-caught and artificially grown products, the nature of consumer tastes in the markets of the European Union, the USA, and Japan as the defining countries for further global trends are explained. 3. Forecasts and recommendations – summarises the development of this market in the world in the near future, including Ukraine, the listed production and consumption problems in the Ukrainian market, and provides appropriate proposals to increase the efficiency of Ukrainian reserves and opportunities to increase the production of fish and seafood both naturally and artificially to stabilise own supply and reduce dependence on imported supplies. The information base of this study is scientific publications of Ukrainian researchers, information from the State Statistics Service of Ukraine, the State Customs Service of Ukraine, statistical and analytical data from the Food and Agriculture Organisation of the United Nations (FAO), the International Trade Centre (ITC), the Organisation for Economic Cooperation and Development (OECD), thematic information from the Internet, developments, and results.

► Results and Discussion

Among the major food groups, fish products for Ukraine are traditionally highly dependent on imports. If earlier, in the first years of independence, there were more opportunities for the development of the Ukrainian fishing industry, then after the annexation of Crimea in 2014, this problem significantly worsened. Statistical data from the State Statistics Service and the State Customs Service clearly demonstrate that their import supplies are of key importance for the Ukrainian fish and seafood market at the present stage. Among the products of group 3 of the UKTZED “Fish, crustaceans, mollusks, etc.”, mainly frozen fish, fresh and chilled fish, fish fillets, and various crustaceans are imported to Ukraine [1; 2]. The volume of imports from abroad of live fish, as well as dried, salted, and smoked fish, shellfish, and aquatic invertebrates, are noticeably lower (Table 1).

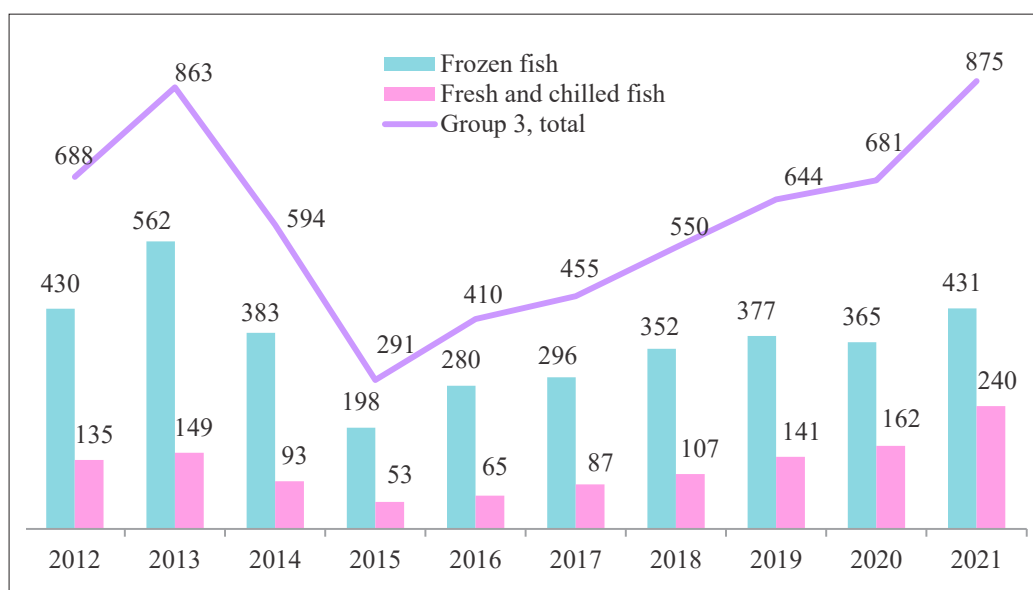
Table 1. Import of product group 3 “Fish, crustaceans, mollusks” to Ukraine, ths. t.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Total	383	415	308	210	273	296	344	358	359	393
Including:										
Frozen fish	303	330	245	181	234	253	291	285	271	286
Fresh and chilled fish	26	23	14	11	10	12	15	23	30	36
Fish fillet	43	49	37	13	23	21	25	32	36	39
Various crustaceans	8	8	4	1	2	3	5	7	12	16

Source: compiled by the author based on [1; 2]

As for the cost indicators of imports, in general, for group 3 of the UKTZED, the amounts of purchases abroad of two items – frozen fish and fresh

and chilled fish, in particular, amounted to about 77% in 2021 (Fig. 1).

**Figure 1.** Import value of product group 3 “Fish, crustaceans, mollusks, etc.”, USD million

Source: compiled by the author based on [1; 2]

Recently, a serious decline in fish and seafood imports in monetary terms was recorded in 2014-2015 due to the annexation of Crimea, hostilities in the Donbas region, which caused a rapid devaluation of UAH, a drop in the purchasing power of Ukrainian consumers, and the curtailment of business activities related to foreign purchases [2]. Restoration of previous import figures for 2012-2013 at the level of USD 700-800 million was achieved only recently. In 2021, the value of imports to Ukraine of product group 3 of the UKTZED was the highest among agri-food products, amounting to USD 875 million. The main suppliers of fish and seafood to Ukraine were European and North American countries, in particular, Norway (35.2% of the import value), Iceland (13.2%), the United States (7.7%), Canada (5.6%), the United Kingdom (4.7%), and Spain (4.4%). In general, they provided almost 71% of foreign supplies of these products to the Ukrainian food market [1; 2].

As for import prices for fish and crustaceans, they are quite different, since the commodity structure of

this group includes a wide range of products. In general, the average import price of group 3 of the UKTZED to Ukraine in 2021 was 2,225 USD/tonne, but it was differentiated in the context of the main commodity items. Thus, 1 tonne of frozen fish imported from abroad costs USD 1,509, the cost of fresh or chilled fish – 6,691 USD/tonne, fish fillet – 2,460 USD/tonne, crustaceans – 4,646 USD/tonne [1; 2].

To clearly demonstrate the functioning of the fish and seafood market in Ukraine, it is necessary to consider their balance in recent years. In addition to the actual products of group 3 of the UKTZED, this also includes ready-made and canned fish, caviar, crustaceans, and shellfish. Current statistics show that Ukraine provides only a fifth of the needs of the domestic market with its own production (extraction of aquatic bioresources by specialised enterprises and fishing by households), while the rest is achieved by import supplies (Table 2). Consequently, the highest import dependence is recorded for this group.

Table 2. Balance of fish and seafood in Ukraine, thousand tonnes

	Consumption fund	Production	Export	Import
2017	460	132	13	338
2018	497	128	13	394
2019	524	128	14	417
2020	517	118	15	424
2021*	554	114	15	461

Note: *preliminary estimates

Source: compiled by the author based on [1-3]

At the same time, Ukrainian exports of fish and seafood are at a consistently low level, which is clearly illustrated by the very high negative balance of foreign trade in them. Thus, at the end of 2021, Ukraine exported products of group 3 of the UKTZED in the amount of USD 57 million, at the same time, the largest revenue was received from sales of fish fillets – about USD 42 million. In quantitative terms, the total export amounted to almost 9 thousand tonnes, of which 5 thousand tonnes were fish fillets. The main markets for fish products last year for Ukraine were Germany, the United States, Denmark, Lithuania, Israel, and Moldova, that is, the geographical structure of Ukrainian exports is also quite extensive [1; 2].

Separately, it is worth highlighting the extraction of aquatic bioresources in Ukraine, which is characterised by a constant decline. Thus, in the first years after independence, it was at the level of 400 thousand tonnes, before the annexation of Crimea it exceeded 200 thousand tonnes, in 2014 it was already 91 thousand tonnes, and in 2021 – only 70 thousand tonnes (including inland water bodies – 23 thousand tonnes, other fishing regions – 36 thousand tonnes, aquaculture – 11 thousand tonnes), of which fish accounted for 42 thousand tonnes. Consequently, the consumption of fish and seafood in Ukraine per person per year is significantly lower than the global average (12 kg vs. 20 kg, respectively) and does not correspond to the rational norm, which is just 20 kg/year [2; 14].

However, official statistics [2] do not reflect the entire quantitative volume of production of aquatic bioresources in Ukraine. A significant part of the Ukrainian market is in the shadows. According to various estimates, about half of the production is not taken into account, so its real volume is now in the range of 140-150 thousand tonnes [2; 7; 18]. Ukraine is a member of the CCAMLR (Commission for the Conservation of Antarctic Marine Living Resources), where it fishes by vessels under the national flag of Ukraine. On average, 21-22 thousand tonnes of aquatic bioresources have been produced in recent years [10]. Notably, FAO forecasts for the period up to 2030 are reduced to a slight increase in the production of aquatic bioresources by Ukraine [16].

In the context of the above, it is also important to understand current trends in the global fish and seafood market. Thus, the global production is characterised by growth in dynamics: 2000 – 124 million tonnes, 2010 – 145 million tonnes, 2019 – 171 million tonnes. The main share of production (about 70%)

is formed by Asian states [14]. The leading countries with the largest supply volumes in this market in 2019 were China (63 million tonnes), Indonesia (13 million tonnes), India (12 million tonnes), Vietnam (7 million tonnes), and the United States (5 million tonnes) [14].

In addition, group 3 of the Harmonised Commodity Description and Coding System “Fish, crustaceans, mollusks” occupies one of the main places in international trade in agri-food products. Over the past ten years, the value of its exports has increased significantly – from USD 82 billion in 2010 to USD 112 billion in 2020 [15]. In the list of agri-food products with the highest export value in 2020, fish and seafood took the fifth place, behind meat products, fruits and berries, cereals, alcoholic and non-alcoholic beverages [15].

Considering specific products in the group of fish and crustaceans, the export of which brings the greatest revenues, then in 2020, traditionally, these were crustaceans (USD 27 billion), fish fillets (USD 23 billion), frozen fish (USD 23 billion), fresh or chilled fish (USD 19 billion), shellfish (USD 12 billion). As for the main exporting countries, their rating was as follows: Norway – USD 11 billion, China – USD 11 billion, Vietnam – USD 6 billion, India – USD 5 billion, Chile – USD 5 billion [15].

However, statistics from FAO and the International Trade Center allow only a quantitative and comparative assessment of the global market. But the qualitative characteristics of its functioning, together with the latest marketing trends, provide much deeper information. A truly global trend in the field of fish farming and seafood has become an increase in the share of aquaculture, that is, products that are artificially grown and bred under fully or partially controlled conditions [8; 12]. Currently, the global supply is divided roughly in half between natural catch yield and industrial aquaculture. The volume of wild fish caught in the world has been at a stable level of 90 million tonnes for more than two decades [11]. However, the existing climatic conditions do not allow increasing the catch of wild fish, which, moreover, is subject to quotas and rationing to preserve this valuable biological resource [17]. Consequently, the quantitative volumes of artificially grown fish and seafood are growing, helping to solve the problem of a constant increase in global demand for them [4]. According to experts, in the near future, the balance will change in favour of aquaculture, and its share will only grow [11].

Consumer trends are developing on the principles of sustainability, and more and more attention is paid to taking care of the environment and avoiding overfishing, when some fish have to be thrown away due to death. The trend for healthy eating remains very popular all over the world, so fish and seafood as a very useful animal protein, easily absorbed by the body, perfectly fits into this concept [12]. The coronavirus pandemic has also made its own adjustments to the consumption of fish products, including in Ukraine [5]. A significant decline was observed in public catering establishments, while a noticeable increase was observed in online sales. As a result, the quantitative consumption of fish and seafood almost did not change, because people began to cook more at home. In countries that set global consumer trends (European Union, USA, Japan), a very wide range of fish and seafood is presented on store shelves, and it is sold ready-made and divided into portions for maximum convenience and time saving [12; 13; 18]. Considering these trends, at the present stage of development, the global fish and seafood market is constantly growing with a dynamic change in consumer tastes, production methods, storage and processing technologies. Although it is not fully saturated, however, the fundamental trends of its functioning are clearly formed for the short and medium-term, expressing an optimal balance in the interests of all interested parties – producers, consumers, and intermediaries.

Ukraine lags behind the world's leading trends in the fish and seafood market. First of all, the culture of consumption of these products has not yet been established, Ukrainian pay little attention to it as a valuable food resource and, accordingly, spend little money. The industry itself, including production and processing, is generally technologically backward with outdated management methods, which leads to a systemic shortage of products for the needs of the domestic market. Business development in this area is at an initial stage, since the volume of goods produced is quite insignificant and limited in the product range.

The peculiarity of fish and seafood consumption in Ukraine is that it has a pronounced seasonal character with a significant increase in the autumn-winter period, which accounts for many traditional holidays for Ukrainians, along with a greater need to provide the body with a variety of nutrients. Considering the product range, the imported products are dominated by frozen fish, while chilled products are far less numerous. Modern freezing technologies allow preserving the original freshness and even texture of fish and seafood meat, so its quality often exceeds the quality of fresh or chilled fish, which reaches the consumer a few days after catching [12]. The most popular types from abroad are herring, mackerel, hake, and various salmon fishes. Ukrainian products on the market are mainly represented by live freshwater fish, such as crucian carp, carp, sazan, silver carp, catfish, pike, etc. In Ukraine, the price of fish and seafood is on average lower than the price of other main types of

meat (beef, pork, chicken), so they are an affordable alternative source of protein. In addition, the price of fish shows the highest elasticity, which is clearly evident from the trend of 2014-2015, when its import and consumption in Ukraine sharply decreased due to the rapid devaluation of the hryvnia and a drop in the purchasing power of the population [6; 19].

At the same time, there are still opportunities to stabilise and increase the production of fish and seafood in Ukraine, in particular, in terms of getting production out of the shadows. As long as it is profitable to operate illegally and official status offers no advantages – structural change is unlikely, but the implementation of state financial support to the industry, with the obligatory condition that only registered companies are granted, can completely change the situation. An important role will be played by the development of specialised industry associations of general and narrow specialisation, which would consider and express the interests of producers and processors as much as possible. Another way to increase domestic production should be to purposefully stimulate aquaculture, which is able to achieve an increase in absolute and relative indicators in the structure of the supply of Ukrainian fish and seafood in a relatively short time. If these conditions are met, the issue of attracting the necessary domestic and foreign investment in the industry will be solved much easier. Although even under such positive circumstances, Ukraine's import dependence on fish and seafood products will remain high, because Ukraine cannot produce most of its foreign products due to the lack of proper natural and climatic conditions.

► Conclusions

The fish and seafood market in Ukraine is the most import-dependent among others, while its own production provides too little for its needs. According to available estimates, about half of the catch yield in Ukraine is in the shadows. To cover the existing deficit, Ukraine imports mainly frozen fish products from abroad, including fresh fish, fillets, and crustaceans. Ukrainian exports of products of this group remain very low compared to imports. The culture of consumption of these products in Ukraine is developing too slowly, so Ukrainians eat much less fish than the average in the world.

Global trends in the international market are set by the European Union, the United States, and Japan. Consumers are now interested not only in a wide product range, but also in minimising the time required to prepare the product. In the world, the catch of wild fish has long remained at a relatively stable level, but there is growth conditioned by aquaculture, that is, artificial and controlled growing. All the time, the emphasis in production is placed on the maximum environmental friendliness of the industry to preserve biological diversity and the necessary number of marine and freshwater fish. For its part, Ukraine is far from the principles of constancy in the process of formation and development of the

fishing industry and aquaculture. The fully comprehensive entrepreneurship and profitability of this industry are mostly in conditions of uncertainty and riskiness. In fact, any negative social, economic, or political factors reduce the capacity of our Ukrainian market for fish products and the volume of their consumption by the population, because it is very sensitive to price changes. Recently, such challenges have been the devaluation of the hryvnia in 2014-2015 and the ongoing coronavirus pandemic.

Despite this, Ukraine has enough opportunities to increase both its own fish catch yield and the development of aquaculture, which will help reduce its dependence on supplies from abroad. Further prospects for study on this topic may include consideration of state support for the industry in the main fish-producing countries and foreign experience in reducing the dependence of the domestic markets of selected countries on import purchases of these products.

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Функціонування ринку риби і морепродуктів в Україні

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► **Анотація.** Україна належить до тих держав, які у значній мірі самі забезпечують власні потреби у різних видах рослинницької і тваринницької продукції. При цьому можливості нашого аграрного сектору дозволяють формувати пропозицію в кількості, яка достатня і для прибуткових поставок в інші країни. Тому при детальному розгляді функціонування більшості ринків агропродовольчої продукції в Україні переважно описуються виробництво та експорт як основні структурні елементи балансу. У випадку ринку риби та морепродуктів спостерігається зовсім інша картина, коли на перший план виходять показники та особливості імпорту й споживання. Проблема імпортозалежності в цьому сегменті з часом тільки наростає, викликана сукупністю об'єктивних та суб'єктивних чинників економічного, соціального та політичного характеру. Важливим з наукової точки зору в цьому контексті є порівняння окремих показників світового та українського ринків риби і морепродуктів, щоб продемонструвати причини різного рівня їх розвитку на сучасному етапі. Необхідність розгляду цих та інших суміжних питань свідчить про актуальність даної тематики. Мета статті – дослідити кон'юнктуру українського ринку риби та морепродукції, значення її імпорту для формування внутрішнього попиту і пропозиції, визначити потенціал виробництва в Україні за рахунок власних спеціалізованих галузей. Використано методи: теоретичного узагальнення, аналізу і синтезу, порівняльної оцінки, історичний, графічний і табличний. Розглянуто динаміку імпорту в Україну продукції групи 3 УКТЗЕД «Риба, ракоподібні, молоски» в кількісних і вартісних показниках, загальний баланс цієї продукції, зміну обсягів її добування українськими підприємствами разом з ключовими причинами, наведено детальну характеристику кількісних і якісних показників функціонування глобального ринку цієї продукції, зокрема з виділенням країн-лідерів у виробництві, експорті, трендах споживання, зроблено оцінку перспектив його розвитку, встановлено орієнтацію на системний розвиток світового ринку риби і морепродуктів в контексті руху товару від первинного виробника до кінцевого споживача, надано пропозиції для суб'єктів українського ринку щодо нарощування власного виробництва через легалізацію діяльності та стимулювання напряму аквакультури. Положення статті спрямовані на доведення до українських галузевих підприємств, потенційних виробників, відповідальних органів державної влади інформації щодо актуальних тенденцій світового ринку риби і морепродуктів з метою виявлення потенціалу внутрішнього виробництва та зниження залежності України від імпорту цієї групи продукції

► **Ключові слова:** імпортозалежність, внутрішній попит, риба і морепродукти, потенціал виробництва, аквакультура



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Assessment of the Ability of Rural Communities to Prepare High-Quality Development Projects

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► **Abstract.** The development of communities and territories requires significant investment. At their expense, communities can restore existing or build new infrastructure, develop businesses, and launch joint development projects. All this is done to improve the living conditions and well-being of the population in communities. As a rule, there are not enough own funds to solve all tasks: community resources are limited and are largely used to meet priority needs. Rural and village communities, almost always financed on a residual basis, are practically unable to provide not only extended, but even simple reproduction of their territories. Therefore, larger projects are implemented using financial or material and technical resources provided from the state budget and/or through international technical assistance projects. This resource is mainly received on a non-refundable basis. The main requirement is for communities to get a sustainable long-term effect from investment. It is also a confirmation of the ability of territorial entities to independently maintain restored or created infrastructure or projects that have been put into operation. In order for these funds to be received by the most worthy and prepared entities, they are distributed through competitive selection mechanisms. Any communities submit project applications for the competition. The most important thing is that the applications meet the requirements of the competition and contain all the information properly submitted. The EU sectoral support competition is one of the largest, both in terms of coverage of Ukrainian communities, and in terms of development areas that can be funded. The results of the competition allow assessing which development problems seem most urgent in rural areas, and whether rural communities have an understanding of the requirements of project approaches. Conclusions and generalisations can serve as a marker for assessing the competitiveness of rural and village communities in the struggle for project resources. In addition – in terms of forming further policies for the development of rural areas and their institutional support. The purpose of the study – assess the ability of territorial communities (with an emphasis on rural and village communities) to prepare high-quality development projects in accordance with European approaches, and provide proposals for improving this ability. To assess the ability of territorial communities to prepare high-quality development projects, statistical and comparative analysis, systematisation and generalisation of information were carried out. The following methods were applied: synthesis and formalisation, graphical and tabular techniques. A study of the activity of communities (with an emphasis on rural and village ones) in terms of preparing development projects was carried out. Their readiness to participate in competitions is analysed. Based on the submitted project applications, a summary of the key priorities for the development of rural and village communities is made. A number of generalisations have been formed regarding the level of project capacity of territorial communities (primarily rural and village communities). Proposals have been developed to improve the ability of communities to attract resources through competitions of this level and their further effective use. Separately, proposals for the introduction of a "project counselling" system within agricultural advisory services and/or regional development agencies (RDA) are provided. The results of the assessment of the ability of rural and village communities to prepare high-quality development projects, the proposed recommendations for their improvement, can be used by central and local authorities, territorial communities, organisations, international technical assistance projects, whose activities are aimed at the development of communities and territories in the implementation of rural development policies both at the national and local levels

► **Keywords:** territorial community, sectoral support, development projects, project capacity, rural or village community, competition

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► Introduction

The development of territorial communities is hindered by the presence of a significant number of economic, social, and institutional problems [1]. A necessary condition for their solution is the attraction and effective use of funds from various sources (budget, credit, investment, grant) [2]. Grant funds and a significant part of budget funds are provided on an irreversible basis, usually through a competitive selection mechanism. This condition requires the preparation of a substantiation (project application, project), based on which the competition commission makes a decision on the allocation of funding. This means that applicants for such funds must have the necessary set of knowledge and practical skills to prepare a project that would meet the competitive conditions, in particular, demonstrate the ability of the community to implement it efficiently and within a certain time frame, and continue the activities reflected in the project application in the future.

An important sign of a successful application is the correct choice of project priorities: some measures solve current issues, and others – lay the foundations for future long-term success. Mistakes when choosing priorities will result in a loss of money and time. An idea of the key priorities of communities can be partially formed based on surveys conducted. According to these data, the desire to build infrastructure facilities is more than twice as high as the desire to develop the social capital of communities through the implementation of soft projects [3]. In a similar way (through surveys), it is customary to assess the quality of project management in communities. The conclusions based on the results of such a survey are quite unambiguous: "...insufficient professionalism of project management in local self-government bodies of amalgamated communities and insufficient level of its organisation" [4]. The key disadvantage of the survey is that the opinion of respondents among community managers or project managers is not always objective, which prevents the establishment of a real idea of the current state of affairs. At the same time, an idea of the quality of project management of territorial communities can be obtained by evaluating their participation in various competitions, in particular, those based on the best world practices. Such competitions in Ukraine in recent years have been: EU sectoral support competitions and Mayors for Economic Growth [5]. They covered the entire territory of Ukraine and were focused on both urban and rural and village territorial communities.

The study of the project capacity of communities in Ukraine is conventionally divided into global-theoretical and applied. The former focus on identifying systemic destructive factors that hinder effective project activity in communities and creating an optimal project model at the grassroots level. Within the framework of the study, models of the strategic planning process in Ukraine or target communities are considered and analysed, the methodology of strategic planning for the development of a territorial community is considered in detail, and the main stages

of the strategic planning process for activities and development are determined. As a result of the study, proposals and/or approaches to measure and assess the level of project competencies based on the construction of an appropriate model for local governments, materials to support project-oriented management of the strategic development of territorial communities in Ukraine, recommendations for practical application in the design of operational part and monitoring of the implementation of planning documents, etc., are prepared. In particular, this can be traced in the studies by A. Ushakova and Yu. Sharov [6], D. Bezugliy [7], O. Borodina [8].

Others base their findings on community-based field research. The purpose of such studies is to assess the implementation of project management practices in territorial communities and identify problems and obstacles that arise before local authorities. Such research is carried out mainly through surveys of local management and project managers to assess knowledge, skills, and abilities on project management issues in territorial entities, and the ability to apply the acquired skills in practice. These studies end mainly with a description of the current situation established based on a survey and the preparation of general proposals for improving project management in communities. The papers of such researchers as A. Polyanska, I. Zapukhlyak, L. Verbovska [9], V. Medvid, I. Koblyanska, O. Kovaleva [4] can be highlighted.

Unlike Ukrainian researchers, foreign researchers have been paying considerable attention to this issue for a long period of time. Long-term study of the issue allows investigating it both in the context of different regions and territories, and focusing more on the features of project management in rural areas. The purpose of these studies is to identify the reasons why many rural development projects fail, and possible ways to mitigate these negative factors. The research is based on factual information about the implementation of projects for which funds from state programmes or international donors were allocated. And, based on the results of studying the issue, they form both a list of erroneous actions and decisions, as well as suggestions for their prevention in the future. An important feature of these studies is the fact that it is not based on technical issues of projects, or methods for evaluating the effectiveness of implementation. The key aspect is to investigate the levels and competencies of local managers, organisational and structural complexity, and identify steps to improve the effectiveness of performers and structures at the grassroots level. Recent studies include M. Muronga and M. Robai [10], Ignacio de los Ríos-Carmenado [11; 12], P. Bórawski [13], E. Cejudo [14], U. Lucy [15], D. Suarez [16].

Systematic research by Ukrainian scientists on the participation of territorial communities in large-scale competitions, with an emphasis on identifying the priority areas of submitted project applications, their quality, the characteristics of applicants, the

reasons for victories and failures, was not revealed. Information about the results of contests is usually provided by the organisers themselves. It forms an idea of the number of participants and winners, and the amount of funds provided. However, this is not enough to assess the project capacity of communities, the ability of local teams to prepare projects of proper quality.

Regarding the results of the sectoral support competition for regional development projects (full name – “Sector Policy Support Program – Support for Regional Policy of Ukraine” [17]; hereinafter – EU sectoral support competition), there is also a little research here: A. Tkachuk made a general analysis of the projects submitted for the competition, highlighted a number of existing problems, and suggested possible steps to solve them [18]; M. Durman investigated the preparation and implementation of projects within the competition in Mykolaivska oblast [19]. Studies of the results of this competition in the context of its various directions and different participants were also not revealed.

For the first time, the task is to assess the ability of territorial communities (with an emphasis on rural and village communities) to prepare high-quality development projects, in particular, the development of entrepreneurship, when the evaluation criterion is victory or loss in the EU sectoral support competition, which was held in Ukraine at the end of 2020. The fact of participation in the competition, winning the competition and their combination as research subjects for assessing the ability of communities to project activities is a new approach that provides an idea of the ability and competence of managers and specialists of territorial communities to prepare applications for participation in competitions with high requirements, win such competitions, and identify priorities that managers in rural and village communities determine for themselves. Approaches are proposed to strengthen the ability of territorial communities, especially rural and village ones, to project activities.

The purpose of the study is to evaluate the opportunities of territorial communities (with an emphasis on rural and village) to prepare development projects, in particular, entrepreneurship development for competitions, the requirements of which are formed in accordance with European standards, and, on this basis, to provide proposals for improving approaches to project activities of communities.

► Materials and Methods

Information from open sources was used when preparing this study, which is related to the organisation and holding of the second EU sectoral support competition. It was based on materials and data posted on the websites of the Cabinet of Ministers of Ukraine and the Ministry of Community and Territorial Development.

The key sources of information in this paper were: the State Regional Development Strategy for 2021-2027, the Agreement on financing “Sectoral

Policy Support Program – Support for Regional Policy of Ukraine”, the procedure for evaluating regional development projects that can be implemented at the expense of the state budget received from the European Union, the requirements for describing a regional development project that can be implemented at the expense of the state budget received from the European Union, the regulations on the competition commission for the selection of regional development projects that can be implemented at the expense of the state budget received from the European Union and the list of projects-winners of the competitive selection of regional development projects that can be implemented at the expense of the state budget received from the EU. To assess the ability of territorial communities to prepare high-quality development projects, an analysis (statistical and comparative), systematisation and generalisation of information on the results of the second EU sectoral support competition was carried out. To this end, data was collected and analysed on the conditions and requirements of the competition specified in the financing agreement “Sectoral Policy Support Program – Support for Regional Policy of Ukraine” [17], the procedure for evaluating regional development projects that can be implemented at the expense of the state budget received from the European Union, the requirements for describing a regional development project that can be implemented at the expense of state budget funds received from the European Union. The study confirmed that equal opportunities were created at the state level for all communities, regardless of their territorial status. And the requirements themselves correspond to the pan-European ones, which are applied when conducting similar competitions. Typical requirements of such competitions are: development of a logical and structural model; economic, social, and organisational substantiation of the project's sustainability; implementation schedule, etc.

As part of the study, the authors processed information about the participants, in particular the winners, of the second EU sectoral support competition. The information that was used was provided in the list of winning projects of the competitive selection of regional development projects that can be implemented at the expense of the state budget received from the EU [20]. The analysis determined the degree of activity of territorial entities (in particular, rural and village entities) within the competition and their main priorities. The use of the synthesis allowed forming a general idea of the ability of territorial communities to prepare development projects and identify priorities in the context of communities. The formalisation method was used at the stage of formulating proposals for improving approaches to project activities of communities. This allowed summarising the information received. It also helped identify the main steps to improve the design capacity of rural and village communities. Graphical and tabular techniques are used to visually present the results obtained.

► Results and Discussion

The EU sectoral support competition was established within the framework of the agreement between Ukraine and the European Union, which was concluded in 2014 [17]. To assess the ability of territorial communities to prepare high-quality development projects this competition is interesting for several reasons:

- firstly, the approaches used in the EU were used to organise and conduct it. In terms of requirements for the project application: the need to prepare a logical and structural matrix, determine who is affected by problems, and who will be the main beneficiary of their solution (including by groups of beneficiaries); to prepare a financial substantiation for the project's activities, coordinating it with the description and work schedule. In terms of organising the evaluation of projects and selecting the winners of the competition: forming a competition commission from among independent experts, with the appropriate set of professional competencies, making the final assessment for projects based on a comprehensive assessment of several experts, each of whom acts independently, selecting projects based on a rating approach (the higher the rating – the higher the place of the project), approving the results of the rating assessment by the relevant ministry (Minregion) without interfering with the evaluation process itself, informing the public about the entire process of collecting project applications and evaluation results through the media and profile sites. The use of such approaches significantly reduced the possibility of “manual” selection of competition winners [18];

- secondly, information about the contest was distributed in advance. Government officials and international technical assistance projects actively trained project managers in communities through various training programmes;

- thirdly, competitive requirements allow excluding a significant part of undeveloped projects at the start – projects that do not provide for socio-economic impact on the development of society in the long term.

Ultimately, only central or local executive authorities, local self-government bodies, and established RDAs were allowed to participate in the competition. Non-governmental organisations and individuals could not participate in the competition. That is why the results of the competition allow assessing the design capacity of local self-government bodies. In total, more than 700 projects from all regions of Ukraine (from cities, villages, towns, regional state administrations (RSA), RDAs, and central executive authorities (CEA) were submitted for the competition. The latter generated 51 projects (7% of the total).

In 2020, projects were submitted for 7 programmes (directions) of the EU sectoral support competition: “Innovative economy and investment”, “Rural Development”, “Tourism Development”, “Human Development”, “All-Ukrainian solidarity”, “Support for the development of depressed territories”, “Effective management of regional development”. The competitive requirements of each of the directions were formulated so that they were accessible to the majority of communities [20].

A competitive programme aimed at supporting depressed territories and improving regional development management has been launched only in 2020 as a reaction to the decree State strategy for regional development for 2021-2027 [1] and understanding the need to implement digital information technologies at the local level [21]. The contestants showed the greatest interest in the following areas: tourism (more than 200 projects were submitted), innovative economy (150 projects), and support for depressed territories (more than 100 projects). 95 projects were generated in the direction of “Rural development” – the fourth result, in which a significant emphasis was placed on supporting entrepreneurship in rural areas.

Analysis of the submitted projects showed that cities, villages, and settlements commissioned a total of 405 projects. When the competition was held, some territorial communities were not yet formed, so the study grouped the information not by territorial communities, but by localities: cities, villages, and settlements. The remaining projects were mainly ordered by the CEAs, RSAs, and RDAs (Fig. 1).

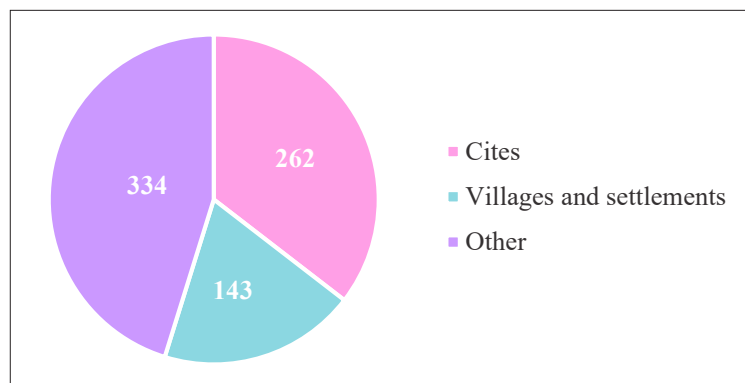


Figure 1. Distribution of projects by customers, units

Source: compiled by the authors based on [22]

Cities, villages, and settlements have prepared 55% of the projects. This is not a very high indicator,

given the focus of the competition and low entrance barriers to the participation of local authorities. The

low activity of communities in cities, villages, and settlements may be conditioned by a lower level of training of their specialists than in the central and regional authorities, RDAs, and the lack of development priorities. A certain confirmation of the latter thesis can be the fact that most localities submitted only one project. But almost all CEAs and RDAs submitted several projects.

The competitive activity of cities was almost twice as high as that of villages and settlements both in general and in the context of individual competitions. The only direction of the competition where

the number of projects submitted from villages and settlements exceeded the number of projects from cities was the direction of “Rural development”. But even here, 11 projects were submitted by cities (rather, urban communities). Villages and settlements became the authors of 40 project applications, which accounted for 43% of the total in this area. As for the remaining areas of the second EU sectoral support competition, projects from village and settlement councils usually accounted for from 10 to 20% of the total volume (Fig. 2).

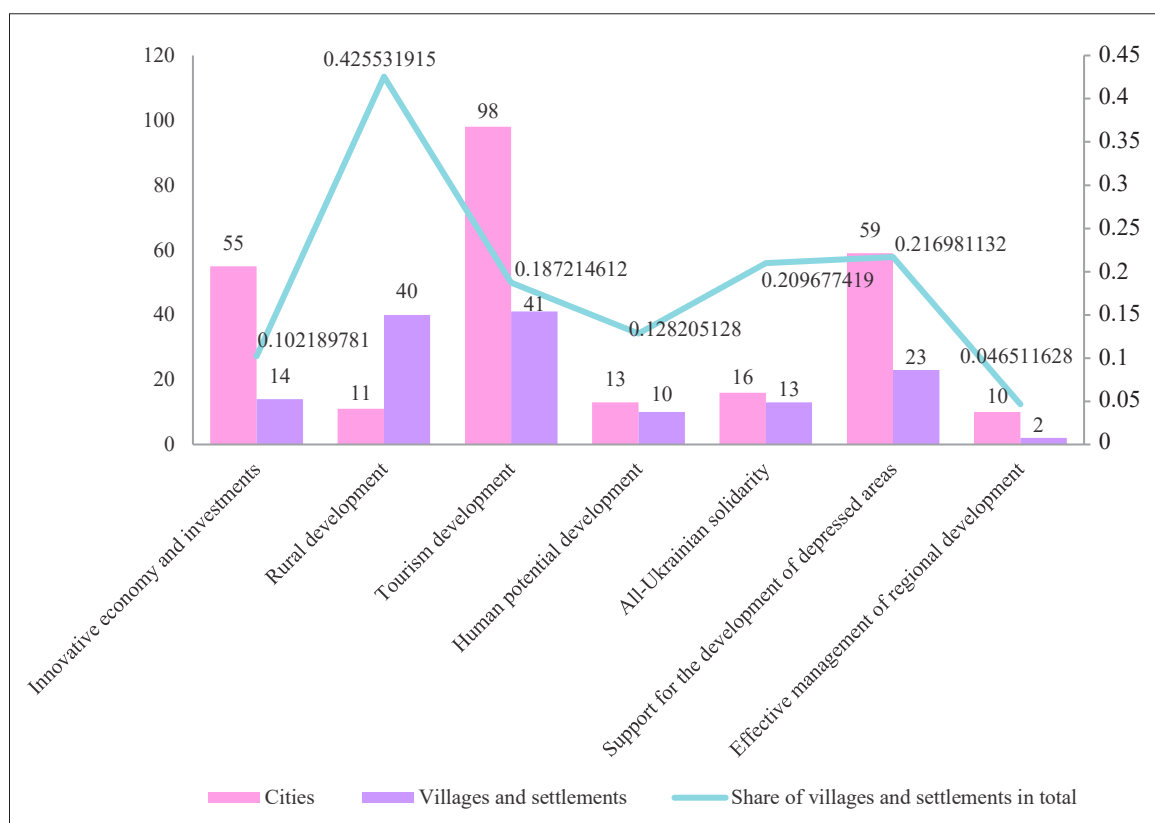


Figure 2. Distribution of projects by customers, units

Source: compiled by the authors based on [22]

The recorded gap between the number of applications from villages/towns and cities reflects the objective difference between the level of provision of local authorities with project management specialists and the level of their training. It is obvious that cities have better opportunities to attract, train, and retain such specialists. It can be assumed that for rural and village communities, maintaining a specialist, especially a project department, seems to be a financially difficult task.

The priorities of urban and rural communities differ somewhat, although they have a lot in common. Most of the proposals from villages and settlements were submitted to the competition in the following areas: “Tourism development” – 28.7%, “Rural development” – 28.0%, “Support for the development of depressed territories” – 16.1%. Urban communities sought to achieve results in the following areas: “Tourism development” – 37.4%, “Support for the

development of depressed territories” – 22.5%, “Innovative economy and investment” – 21%. There is an increased interest of applicants from all localities of interest in the positions “tourism” and “depressed territories”. It can be noted that urban communities have a slightly clearer focus of project interests: 3 key areas account for 80% of applications against 72% of rural communities, although the difference is insignificant.

There is a concentration of all localities without exception in the tourist direction of development: 63% of all projects related to “Tourism development”. There is reason to assume that the choice of “Tourism development” is not conditioned by the fact that tourism can become one of the sectors of the economy for communities, the development of which will stimulate the expansion of local trade, the hospitality industry, transport, etc. Most likely, this topic seemed to most applicants the easiest from the

standpoint of both the preparation of the project application and its implementation. This thesis is confirmed by the analysis of names and content of project applications: “Reconstruction of the building at 11 Dobrolyubova Str. in Zaporizhzhya”, “Overhaul of facades of cultural building and improvement of adjoining territory”, “Reconstruction and arrangement of improvement elements on 5 Dnistrovska Naberezhna Str., Shepetivsky district, Khmelnytska oblast, Sudilkov village. Improvement of recreation area)” [20]. The above-mentioned projects are very similar in their essence and content to the “re-faced” applications for the competition of the state fund for regional development, since it is there that it is necessary to give the project name identical to the name of the design and estimate documentation. The analysis of the goals and objectives of such project applications only gives grounds for such a conclusion:

projects are local, not regional in impact, practically do not contribute to socio-economic cohesion or strengthen the ability of communities to develop, as required by the competition conditions. In addition, the presentation of the content of applications deviates quite strongly from the requirements defined by the terms of the competition.

These facts give grounds for another assumption: the key factor of participation in the competition was not the desire to create conditions for the sustainable development of society, but the availability of previously prepared developments, and the apparent simplicity of a particular direction of the competition. The latter, as it turned out, was quite deceptive: out of 219 applications submitted for the direction of “Tourism development”, only 7 or 3.2% of the population became winners (Fig. 3).

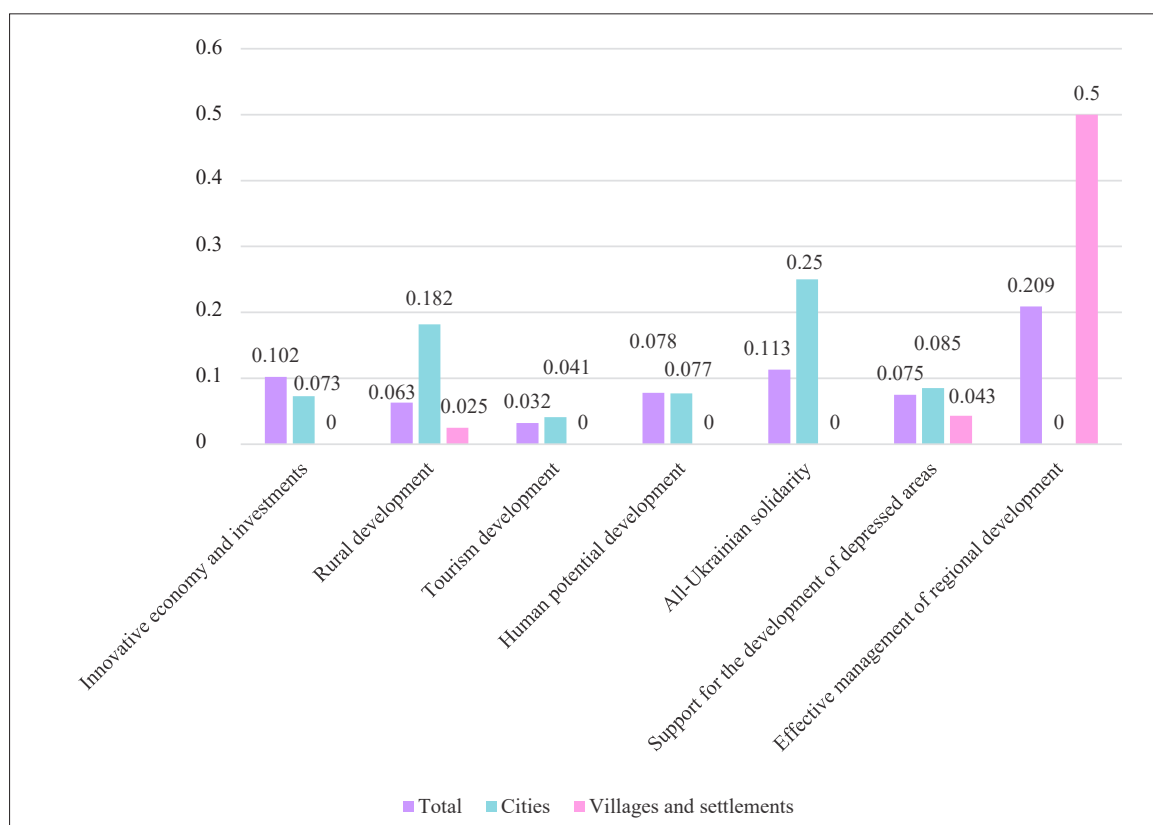


Figure 3. Winning projects by direction and submission, %

Source: compiled by the authors based on [22]

The analysis of winning projects by direction and category of applicants reinforces the conclusion that was already made earlier: there is a large gap between cities, villages, and settlements in the preparation of not only projects in general, but also high-quality projects. In general, among the 56 winning projects, only 3 (5.4% of the total number) were from villages and settlements: one each for the positions “Rural development”, “Support for the development of depressed territories” and “Effective management of regional development”. But cities submitted 20 successful applications (35.7% of the total). The winners from cities were not presented only

in the direction of “Effective management of regional development”. It is most interesting that in such an important area for rural communities as “Rural development”, almost every 5th project from cities was successful, and only 1 in 40 – from villages and settlements.

The winning projects of the competition were focused on the development of territories, starting from several communities and ending with individual regions. Not all of them were aimed at the formation of entrepreneurship: some were focused on solving environmental or social issues, developing education, developing the environment, etc. (Fig. 4).

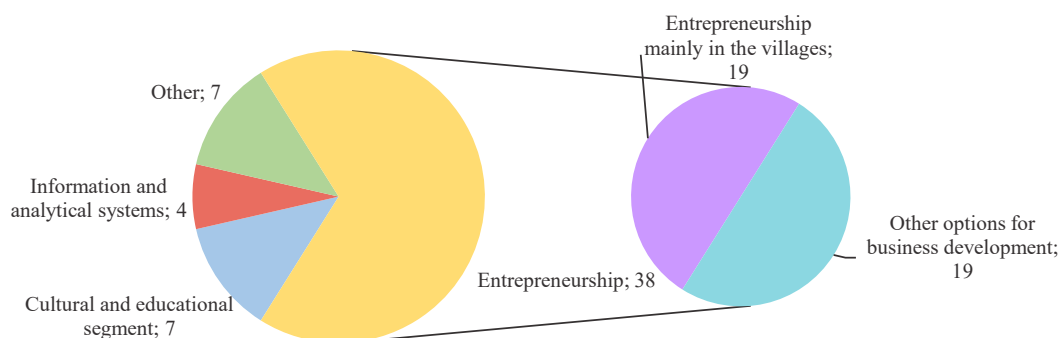


Figure 4. Distribution of winning projects by direction, units

Source: compiled by the authors based on [22]

According to the authors of this study, 38 projects, or 67.9% of the total number of winners, had a direct impact on the development of entrepreneurship. Some of them include the effect of a time-delayed impact on the development of entrepreneurship (for example, “Development of human capital in the agro-organic sector of the economy” or “Technological future of Vinnytska oblast. Teaching students of the region the basics of robotics, programming, and innovative entrepreneurship”). Others relate only to a narrow business segment (“Aquaculture Business Launch incubator (AQUABATOR)” or “EXPORT AID – support for export activities of the Chernihivska oblast”). All of them, to one degree or another, contribute to the development of entrepreneurship, and, accordingly, to improving social, economic, and territorial cohesion and improving the well-being of citizens, which corresponds to the goal of the competition.

In terms of supporting entrepreneurship in rural areas, the situation is somewhat different. The winners of a third of projects aimed, to one degree or another, at supporting entrepreneurship in rural areas. However, the vast majority of them are not submitted by rural communities. The latter have only one such project on their account: “Development of enterprises in the field of cheese making in the communities of the Rivnenska and Volynska oblasts”. The other two relate only indirectly to entrepreneurship, although they are aimed at solving equally important issues: ecology (“Measures for sorting and disposing of garbage in nature reserves of the Carpathians”) and digitalisation (“Introduction of smart city elements in rural communities of the Cherkaska oblast”). Thus, another thesis expressed by the authors earlier is confirmed: rural communities do not yet consider the development of entrepreneurship as one of the main priorities [3]. Therefore, there is a significant number of projects for the development of entrepreneurship from regional authorities, city councils, RDAs, and CEAs. At the same time, as a key player in the development of rural entrepreneurship, village and settlement councils remain extras in this process.

► Discussion

The conducted research gives grounds for the assumption that in Ukrainian practice, when analysing project activities in rural areas, the effectiveness of forces and

measures taken, and evaluating the results obtained, insufficient attention is focused on the human component and on the issues of interaction between different participants in project activities. The main emphasis, as already noted, is placed either on the general description of the situation and the construction of some mathematical models that should simplify the management system, or on the study of the problems of individual communities without its further transformation and generalisation. But foreign approaches aim to get answers to slightly different questions: how well local performers are prepared, both in terms of general project knowledge and managerial abilities to implement winning projects, especially large-scale ones. And also: evaluate the effectiveness of the project mechanism, starting from the preparation of an application for funding and ending with a report on the results achieved. This approach allows not only identifying the “bottlenecks” of the existing system of rural development, but also proposing solutions to reduce the negative impact and decrease the share of projects that were not implemented or were implemented improperly.

Within the framework of this study, the first steps were taken that would allow implementing similar approaches in Ukraine. The authors evaluated the effectiveness of the competition not because of the volume of applications submitted or the number of winning projects. The assessment was supposed to provide an understanding of whether rural communities are sufficiently ready to prepare high-quality projects, and whether they can independently identify the key problems that hinder further development. And, based on the results obtained, relevant conclusions and suggestions for improving the situation have been prepared.

► Conclusions

An analysis of project applications for the EU sectoral support competition shows that villages and settlements are less active than cities. In the project work, they submitted only 19% of all projects from villages and settlements against 35% from cities. This is despite the number of villages and settlements exceeding cities by several times. The most likely reasons are distrust of the possibility of winning the competition due to negative previous experience and difficult competitive conditions with a simultaneous

shortage of high-quality specialists. The overall level of preparation of project applications from rural localities for competitions held according to European rules is low. The total share of the winners of the EU sectoral support competition was 7.6% (of all applications submitted). For villages and settlements, this figure was 2.1% (of the number of applications from such localities). But for cities – still 7.6%. Such a gap in quality indicators also indicates problems with the staffing of rural communities with proper specialists.

Among the project applications that were selected as part of the EU sectoral support competition for further financing, 2/3 related to the development of entrepreneurship. 19 out of 56 submitted projects were aimed at developing entrepreneurship in rural areas, but only 1 out of 19 winning applications in rural areas (5.3%) was prepared directly by the rural community. Thus, in the eighth year of decentralisation, creating conditions for business development is still not a priority for the authorities in villages and settlements. While maintaining the status quo, it is difficult to hope for a resumption of business activity in rural areas and a decrease in the rate of its depopulation. It is obvious that rural communities need project management specialists who would be able

to analyse the conditions of a particular competition and prepare a high-quality application. But perhaps a more important task is to form an understanding among local authorities of the importance of the economy for the sustainable development of society.

Given the limited opportunities of rural communities to attract project managers, the way out of this situation could be state support for consulting for rural communities, including “project counselling” within the framework of agricultural advisory services, as is practised in EU countries. Community cooperation with existing RDAs should also be encouraged in various ways. There is an evident need to include at least the basics of project management and fundraising in the training programmes of specialists of the management bodies of rural and village communities. The lack of “project” knowledge and skills of specialists in rural communities determine their loss in various competitions in advance, forming the opinion of the heads of communities about the inexpediency of further participation in such competitions and/or training of specialists. It is possible to break out of this circle only by creating a unified system where successful “students” receive a monetary reward in the form of a “prize” for the implementation of the project.

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Оцінка спроможності сільських громад готувати якісні проекти розвитку

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► **Анотація.** Розвиток громад та територій потребує значних інвестицій. За їхній рахунок громади можуть відновлювати існуючу, або будувати нову інфраструктуру, розвивати бізнес, запускати спільні проекти розвитку. Все це – задля покращення умов проживання та добробуту населення в громадах. Власних коштів для вирішення всіх завдань, як правило, не вистачає: ресурси громад обмежені і значною мірою використовуються для закриття першочергових потреб. Сільські та селищні громади, котрі майже завжди фінансувалися за залишковим принципом, практично не мають змоги забезпечувати не те що розширене, але навіть просте відтворення своїх територій. Тому більш масштабні проекти впроваджуються завдяки фінансових коштів або матеріально-технічних ресурсів, котрі надаються з Державного бюджету та/або через проекти міжнародної технічної допомоги. Цей ресурс надходить, переважно, на безповоротній основі. Основна вимога полягає в отриманні громадами сталого довгострокового ефекту від здійснення інвестицій. А також – підтвердження здатності територіальних утворень самостійно утримувати відновлену або створену інфраструктуру чи запущені в дію проекти. Для того, щоб ці кошти надійшли найбільш достойним і підготовленим, їхній розподіл відбувається через механізми конкурсного відбору. На конкурс подають проектні заявки будь-які громади. Головне, щоб заявки відповідали вимогам конкурсу, та містили всю інформацію, подану належним чином. Конкурс Секторальної підтримки ЄС – один з найбільших, як за охопленням громад України, так і за напрямками розвитку, які можуть бути профінансовані. Результати конкурсу дозволяють оцінити, які саме проблеми розвитку видаються найбільш нагальними в сільській місцевості, чи є в сільських громадах розуміння вимог проектних підходів. Висновки і узагальнення можуть слугувати певним лакмусовим папірцем для оцінки конкурентоспроможності сільських і селищних територіальних громад, в боротьбі за проектні ресурси. А також – в частині формування подальших політик розвитку сільських територій і їхньої інституціональної підтримки. Мета статті – оцінити спроможність територіальних громад (з акцентом на сільські та селищні) готувати якісні проекти розвитку відповідно до європейських підходів, і, надати пропозицій щодо посилення такої спроможності. Для оцінки спроможності територіальних громад готувати якісні проекти розвитку проведено статистичний та порівняльний аналіз, систематизацію та узагальнення інформації. Застосовано методи: синтезу і формалізації, графічні та табличний прийоми. Здійснено дослідження активності громад (з акцентом на сільські та селищні) в частині підготовки розвиткових проектів. Проаналізовано їхню готовність до участі в конкурсах. На основі поданих проектних заявок зроблено узагальнення щодо ключових пріоритетів розвитку сільських та селищних громад. Сформовано низку узагальнень щодо рівня проектної спроможності територіальних громад (насамперед – сільських та селищних). Підготовлено пропозиції щодо посилення спроможності громад залучати ресурси за допомогою конкурсів такого рівня та їхнього подальшого ефективного використання. Окремо надано пропозиції щодо впровадження системи «проектного дорадництва» в рамках діяльності сільськогосподарських дорадчих служб та/або агенцій регіонального розвитку (далі – АРР). Результати проведеної під час дослідження оцінки спроможності сільських та селищних територіальних громад готувати якісні проекти розвитку, запропоновані рекомендації з їх вдосконалення, можуть бути використані центральними та місцевими органами влади, територіальними громадами, організаціями, проектами міжнародної технічної допомоги, діяльність яких спрямована на розвиток громад та територій під час формування та реалізації політики сільського розвитку як на національному, так і місцевому рівні

► **Ключові слова:** територіальна громада, секторальна підтримка, розвиткові проекти, проектна спроможність, сільська або селищна громада, конкурс

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