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Optimisation of production and modelling of production costs in farms

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▸ **Abstract.** A significant area of improvement of the economic efficiency of agricultural enterprises, especially in the context of martial law, is to optimise production and use of resource potential. The purpose of this study was to develop scientific and practical recommendations for optimising the production activities of farms. The study employed the following methods: system analysis and synthesis to determine the reserves of the types of resources involved; economic-mathematical modelling and optimisation to determine best solutions; analytical-calculation method to calculate production indicators; correlation and regression analysis to determine the dependence of milk production costs on resource consumption; graphical method and extrapolation to find the values of the regression function. The principal stages and features of building an economic-mathematical model for optimising the resource potential of enterprise were identified. The model was used to analyse data, identify reserves of resource potential, find an optimisation solution for product sales volumes using the Solution Search spreadsheet tool, and adopt a strategy for improving economic efficiency. The study offered a solution for the economic and mathematical modelling of the best structure of production of a farm, which factors in the available production resources. The modelling found that the maximum income can be obtained by redistributing the production volumes of certain types of products and, accordingly, the resources for their production, considering the standard costs of production per unit of product, prices for products and resources. Using the modelling, the study obtained a regression dependence of the cost of milk produced in household farms on the cost of feed, labour costs, wages, and the number of cows. The study found the impact of certain types of resources on the production cost and builds the corresponding graphical dependencies. The practical value of the findings of this study lies in the possibility of using the recommendations directly by members of farms in planning, organising production activities, and optimising the use of resource potential

▸ **Keywords:** optimisation of the production structure; modelling; regression analysis; production resources; household farming

▸ Introduction

In market conditions, especially during the period of martial law in Ukraine, mechanisms for optimising the production activities of agricultural producers of all forms of management: enterprises of various forms of ownership, farm enterprises and household farms, are becoming increasingly important. Considerable changes in the external environment of agricultural enterprises require the development of innovative methods, approaches, and management systems that determine the need for economic and mathematical modelling. Most agricultural enterprises focus on insufficiently formed and clear goals, which is conditioned by the lack of suitable

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tools and methods for solving optimisation problems among agricultural specialists (Pasechko *et al.*, 2019; Vishnevsky *et al.*, 2020).

M. Levina Kostiuk *et al.* (2021) covered the methodological foundations for optimising the production activities of farms based on economic and mathematical modelling to ensure their sustainable development and expanded reproduction and the development of practical recommendations. S. Nuzhna & N. Samarets (2018) analysed some aspects of the development and construction of an economic and mathematical model for optimising the production resources of agricultural enterprises and finding reserves and rational use of resource potential, improving the economic efficiency of production.

R. Skrynkovskyy *et al.* (2022) improved the structural scheme (triple continuum model as a conceptual scheme of information technologies) of financial and technological processes management, innovation risks, which considers the impact of innovations on the activities (internal variables, business processes) of the enterprise, restrictions (on production, sales, supply, financing), and the conditions for their compliance with the best production (sales) volume, as well as the synergistic effect in the context of profit maximisation, in the "type of innovation – type of development" system, in the system of sustainable development values. L. Malyarets *et al.* (2019, 2020) describe the formulation of a multi-objective task of optimising the indicators of enterprise development and substantiate the choice of a genetic algorithm for solving the problem of multi-objective optimisation of enterprise development indicators by analysing the disadvantages and advantages of modern methods for solving multi-objective optimisation problems.

An analytical approach to the construction of partial criteria in a multi-objective optimisation problem in the economy was considered as stochastic dependencies of production components on indicators in the form of latent factors that should be noted by factor analysis (Audet *et al.*, 2021). D. Bertsimas & N. Kallus (2019) investigated an analogous stochastic optimisation problem, where some decision variables, such as price, may be affected by uncertainty, and their causal outcomes are unknown. When developing a model for forecasting the volume of sales of agricultural enterprise, Y. Kharchenko (2021) recommends using adaptive modelling to improve operational planning of production and, if necessary, quickly make changes to production plans. It is proposed to use the developed automated decision-making system based on the information-logic model as a result of research on the use of modelling for making best management decisions (Domaskina & Kolomoytsev, 2018).

Ways of solving the problem of efficient operation of farms and optimisation of agricultural production were proposed in scientific studies by many researchers. However, modelling the production activities of household farms has not received sufficient attention in such research. Thus, the purpose of this study was to develop economic and mathematical models and recommendations for optimising production of products and improving the economic efficiency of economic activity.

To achieve this, the following tasks need to be completed:

– to develop a mathematical model for optimising production and allocating resource potential for farms;

– using the model, to determine the optimised sales volumes of each type of product and, accordingly, the required quantities of each type of resource;

– to develop a correlation and regression model of the dependence of production costs on resource consumption, and to build the corresponding graphical dependencies.

Materials and Methods

The method of system analysis and synthesis was used to determine the types of resources involved in production in general and for certain types of products, as well as their limitations. Furthermore, the study used economic and mathematical modelling and optimisation methods to determine the best solutions for resource provision, as well as the analytical and calculation method to determine the cost of resources. Using the methods of regression analysis, the study derived an analytical dependence of milk cost on the cost of certain types of resources (feed, labour, number of livestock, etc.), determined the magnitude of the impact of resource costs on production cost, and built corresponding graphical dependencies.

The efficiency of agricultural production and the development of recommendations for its improvement were assessed according to the indicators of production of household farms (HF) in the Menskyi district of Chernihiv region for 2022, namely, based on the financial statements of the owner (based on research materials according to the scientific and technical complex programme "Scientific research and development of methodological approaches and economic and regulatory systems for the expenditure of labour and material resources in the production of products (works, services) to ensure and improve the socio-economic development of the agro-industrial complex and territorial communities for 2021-2023") (Report on the implementation..., n.d.).

The structural model of the problem, considering the consumption rates of resources, their quantity and sales prices, is presented below.

$$\begin{cases} R_{max} = c_1x_1 + c_2x_2 + c_3x_3 + \ldots + c_{ij}x_j \ \ldots + c_nx_n \\ a_{11}x_1 + a_{12}x_2 + a_{13}x_3 + \ldots + a_{ij}x_j \ \ldots + a_{1n}x_n \le Q_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 + \ldots + a_{ij}x_j \ \ldots + a_{2n}x_n \le Q_2 \\ a_{i1}x_1 + a_{i2}x_2 + a_{i3}x_3 + \ldots + a_{ij}x_j \ \ldots + a_{in}x_n \le Q_m \\ a_{m1}x_1 + a_{m2}x_2 + a_{m3}x_3 + \ldots + a_{ij}x_j \ \ldots + a_{mn}x_n \le Q_m \\ x_1 \ge 0, x_2 \ge 0, x_3 \ge 0, \ldots, x_n \ge 0 \\ j = 1, \ldots, n; i = 1, \ldots, m, \end{cases} \quad (1)$$

where R_{max} is the income from the sale of farm products (UAH); c_j is the sale price of a unit of the j-th type of manufactured products (UAH); x_j is the number of products of the j-th type (100 kg); a_{ij} is the cost norms of the i-th type of resource required to produce a unit of the j-th type of product (UAH/100 kg); Q_i is the factual volume of the i-th type of resource (UAH); *n* is the number of types of products produced by the farm; *m* is the number of types of resources used in production.

The task is solved using the *Excel* spreadsheet processor. The farm under study produces four types of agricultural products (n=4) and uses 9 main types of resources

(m=9). The following notation was introduced for production volumes and, accordingly, the resources used: x_1 is the amount of milk, 100 kg; x_2 is the amount of pork, 100 kg; x_3 is the amount of eggs, thous. pcs.; x_4 is the amount of cattle meat, 100 kg; Q_1, Q_2, ..., Q_9 are the factual amounts of resources, respectively: labour costs, feed costs, energy costs, maintenance, animal protection products, fuel, bedding, other direct costs, cost of services.

When determining the analytical model of production indicators using the methods of correlation and regression analysis, the information base of the study included data on resource consumption and production costs based on the business results of household farms in Chernihiv and Volyn regions in 2022 (Report on the implementation..., n.d.). The modelling of agricultural production indicators by regression analysis was performed using computer software “RegMod” (Borysenko & Bosiy, 2010), which provides automation of calculations of the regression equation parameters and assessment of the adequacy and definition of economic indicators.

Results and Discussion

When optimising the resource potential of production, it is necessary to determine the necessary volumes of resources and their rational correlation for the economic activity and maximum income (Zhmudenko & Lishchuk, 2021). The model of optimising the resource potential of a farm can be represented as a flowchart presented in Figure 1.

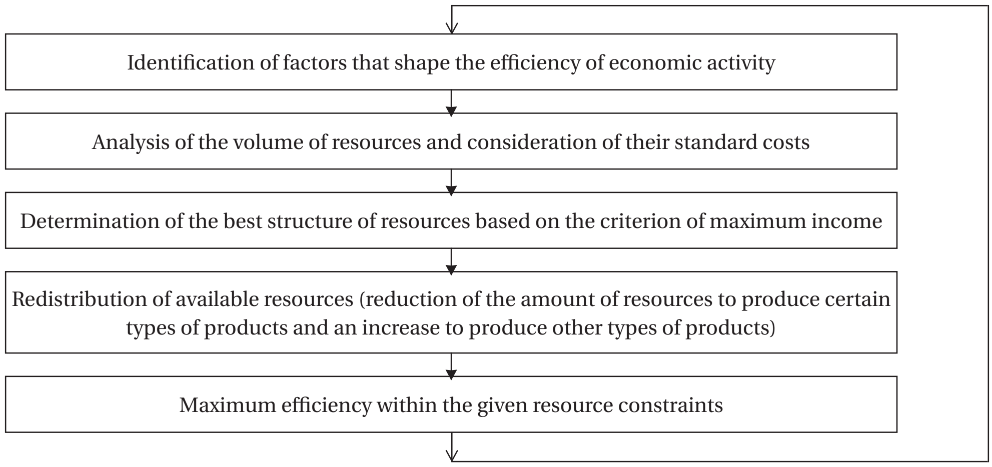

Figure 1. A model for optimising the resource potential of a farm

Source: compiled by the authors of this study

The task is to find the maximum revenue from the sale of products, considering the constraints of production resources. The numerical mathematical model is based on the data on the consumption of resources to produce agricultural products. The main activity of the farm is the production of livestock products, namely: raising pigs, chickens, cattle for the sale of milk, cattle meat, pork, and chicken eggs.

According to the annual report of production costs of household farms, Table 1 summarises the costs of each type of input, their total volumes, and sales prices by product type.

Table 1. Expenditure of material resources to produce agricultural products

Resource	Resource consumption rates per unit of output, UAH/100 kg				Amount of resources, UAH
	milk	pork	eggs	cattle meat	
Remuneration of labour	254.19	1,386.67	829.11	1,246.53	28,279
Cost of feed	110.63	1,004.71	581	2,238.89	16,472
Energy resources	11.79	43.14	35.21	83.33	1,282
Current repairs	16.26	58.82	42.25		1,582
Animal protection products	16.1	109.8	28.17	152.78	1,886
Fuel	22.76	143.14	72.77	145.83	2,628
Bedding	7.32	39.12	14.08	41.67	728
Other direct costs	30.49	509.8	187.79	152.78	4,580
Cost of services	18.7	68.63	23.47	173.61	1,999
Sales price of 100 kg of products	750	4,400	2,250	4,300	
Products sold, 100 kg	80.00	2.70	2.90	1.44	

Source: developed by the authors of this study based on the Report on the implementation of the thematic plan of research activities of the research institute “UkrAgroProductivity” (n.d.)

According to the structural model of optimisation of the resource potential of the agricultural household, the numerical detailed mathematical model of the problem can be represented as a system of equations:

$$\begin{cases} R_{max} = 750\,x_1 + 4{,}400\,x_2 + 2{,}250\,x_3 + 4{,}300\,x_4 \\ 254.19\,x_1 + 1{,}386.67\,x_2 + 829.11\,x_3 + 1{,}246.53\,x_4 \le 28{,}279 \\ 110.63\,x_1 + 1{,}004.71\,x_2 + 581\,x_3 + 2{,}238.89\,x_4 \le 16{,}472 \\ 11.79\,x_1 + 43.14\,x_2 + 35.21\,x_3 + 83.3\,x_4 \le 1{,}282 \\ 16.26\,x_1 + 58.82\,x_2 + 42.25\,x_3 \le 1{,}582 \\ 16.1\,x_1 + 109.8\,x_2 + 28.17\,x_3 + 152.78\,x_4 \le 1{,}886 \\ 22.76\,x_1 + 143.14\,x_2 + 72.77\,x_3 + 145.83\,x_4 \le 2{,}628 \\ 7.32\,x_1 + 39.12\,x_2 + 14.08\,x_3 + 41.67\,x_4 \le 728 \\ 30.49\,x_1 + 509.8\,x_2 + 187.79\,x_3 + 152.78\,x_4 \le 4{,}580 \\ 18.7\,x_1 + 68.63\,x_2 + 2{,}347\,x_3 + 173.61\,x_4 \le 1{,}999 \\ xj \ge 0;\ j = 1, \dots, 4. \end{cases} \quad (2)$$

The modelling has revealed that farms can achieve maximum income by producing certain types of products and in their certain volumes. The best redistribution of available resources was obtained considering the production of all types of products, the use of production resources, the standard costs of producing a unit of each type of product and its selling price in 2023: milk – 850 UAH/100 kg, pork – 5,500 UAH/100 kg, eggs – 3,200 UAH/1000 pieces, cattle meat – 5,100 UAH/100 kg. As a result of solving the problem using the *Excel* spreadsheet processor, the optimised volumes of material resources to produce agricultural products were obtained, which are presented in Table 2.

Table 2. Optimised consumption of resources for production

Products	Amount of resources, UAH	Resource growth coefficient
Milk	34,177	0.88
Pork	6,728	0.74
Eggs	14,329	5.0
Cattle meat	4,235	0.69
Total resources	59,469	1

Source: compiled by the authors of this study

The modelling results suggest that if the available resources are redistributed to the production of certain types of products according to Table 2 and considering the sales prices in 2023, the company's resources will be used most efficiently.

The increase in the values of the indicators of the efficiency of production of agricultural enterprises compared to the previous year, expected as a result of optimising the allocation of production resources, is summarised in Table 3.

Table 3. Performance indicators before and after production optimisation

Products	Performance indicators									
	for 2022				planned after optimising resource allocation					
	Revenue, UAH	Prime cost, UAH	Profit, UAH	Profitability	Income, UAH	Growth coefficient	Prime cost, UAH	Profit, UAH	Profitability	Sales, 100 kg
Milk	60,000	39,059	20,941	53.61	59,500	1.05	34,177	25,323	74	70
Pork	11,880	9,082	2,798	30.8	10,800	0.91	6,728	4,072	60.5	2
Eggs	6,525	5,260	1,265	24.05	25,280	3.87	14,329	10,951	76.42	7.9
Cattle meat	6,192	6,099	93	1.52	5,300	0.86	4,235	1,065	25.14	1
By HF	84,597	59,500	25,097	42.18	100,880	1.19	59,469	41,411	69.6	

Source: compiled by the authors of this study

The above profitability figures will be slightly reduced for the cost of resources at the time of calculation in the HF. The performance indicators after optimisation show that the maximum income can be achieved by increasing the production of chicken eggs (x_3), since the income received from the sale of chicken eggs is much higher than when raising cattle or pigs for milk (x_1), pork (x_2) and cattle meat (x_4). Based on the results obtained, the farms under study have the potential to increase the level of profitability and efficiency of production activities. For agricultural producers, it is vital to forecast the price of products sold on the Ukrainian market, as emphasised, for instance, by N. Shyian *et al.* (2021). Next, the study considered the correlation and regression modelling of the dependence of milk production costs on the consumption of certain resources (Table 4) required to produce the final product.

Table 4. Input data for determining the model of milk cost dependence on influencing factors

Number of livestock, total heads	Labour costs, man-hours/100 kg	Labour remuneration, UAH/100 kg	Feed cost, UAH/100 kg	Production cost, UAH/100 kg
3	14.3	254.19	110.63	488.24
2	16.38	281.48	138.29	580.7
1	14.2	366.68	147.44	661.7

Table 4, Continued

Number of livestock, total heads	Labour costs, man-hours/100 kg	Labour remuneration, UAH/100 kg	Feed cost, UAH/100 kg	Production cost, UAH/100 kg
3	7.64	170.20	524.40	737
5	9.88	226.50	348.75	632
1	14.83	221.95	213.75	527.45

Source: developed by the authors of this study based on the Report on the implementation of the thematic plan of research activities of the research institute "UkrAgroProductivity" (n.d.)

According to the methodology for determining the regression equation, the economic and mathematical model includes those types of resource costs that have a substantial impact on the prime cost. The modelling process uses regression analysis to determine the regression equation for the specified dependent variable (milk production cost) on the independent variables: feed cost, labour costs, wages, and the number of cows (Fig. 2).

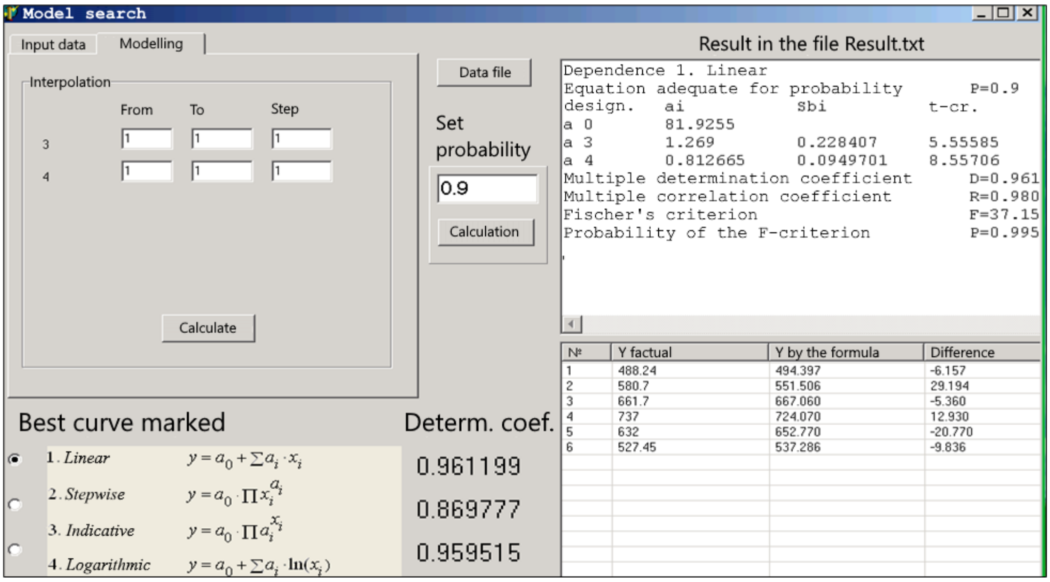

Figure 2. The panel of the regression analysis programme when creating a model
Source: developed by the authors of this study based on V. Borysenko & M. Bosiy (2010)

As a result of processing the input data of Table 2 with a regression analysis computer software, the analytical model was determined in the form of a linear function:

$$C = 81.93+1{,}269\times L_R+0.813\times F, \quad (3)$$

where L_R is the labour remuneration, UAH, calculated per 100 kg of milk produced; F is the cost of feed, UAH per 100 kg of milk.

The adequacy of the obtained regression equation is evidenced by the following statistical indicators: the coefficients of multiple determination are not less than 0.96, significant at the probability level of 0.99, and the regression coefficients are significant at the same probability. In this case, the regression coefficients of the labour costs and the number of cows in household farms were insignificant at a given probability, and the software excluded these independent variables from the analysis, i.e., the columns of the correlation matrix of the original data were excluded in the output table. This situation occurs frequently in research and is usually the result of the following circumstance: the variance of a variable is very small relative to its mean. Then it is concluded that at any value of this variable in this range of studies, the function (the desired indicator) will not change significantly (Lu, 2019; Borysenko, 2022).

According to the defined equation, it is possible to calculate the value of the cost price (function) depending on changes in the value of production inputs (independent variables) (Hassani *et al.*, 2019). To verify the adequacy of the created model, the working panel of the program displays the factual prime cost values and those calculated using the regression equation. The maximum deviation of the model's prime cost of 551.51 UAH/100 kg with labour costs of 281.48 UAH/100 kg and feed costs of 138.29 UAH/100 kg from the factual value is 5%, which is sufficiently accurate to use the resulting relationship in forecasting calculations. As a result of the software processing, elasticity coefficients were also obtained, which show how much the prime cost will change in percentage terms if the values of these variables change by 1% and are 0.532 and 0.332% for labour costs and feed costs, respectively.

According to the established mathematical dependence, the cost of milk produced is determined according to the planned labour and feed costs. The results of modelling the cost of milk produced by household farms in relation to feed costs with fixed labour costs are summarised in Table 5.

Table 5. The value of the cost of milk produced by the HF according to the regression model in relation to feed and labour costs

Feed cost, UAH/100 kg	Production cost, UAH/100 kg	
	at a wage of 250 UAH/100 kg	at a wage of 450 UAH/100 kg
100.00	480.44	734.24
200.00	561.71	815.51
300.00	642.97	896.77
400.00	724.24	978.04
500.00	805.51	1,059.31
600.00	886.77	1,140.57

Source: compiled by the authors of this study

Regression modelling allows planning or adjusting the cost of production for future periods, considering changes in the cost of resources, and compare the real production figures with the modelled ones. The corresponding graphical dependencies of the cost of milk production in the subsidiary farms on the cost of feed at fixed values of another variable – labour remuneration costs – are presented in Figure 3.

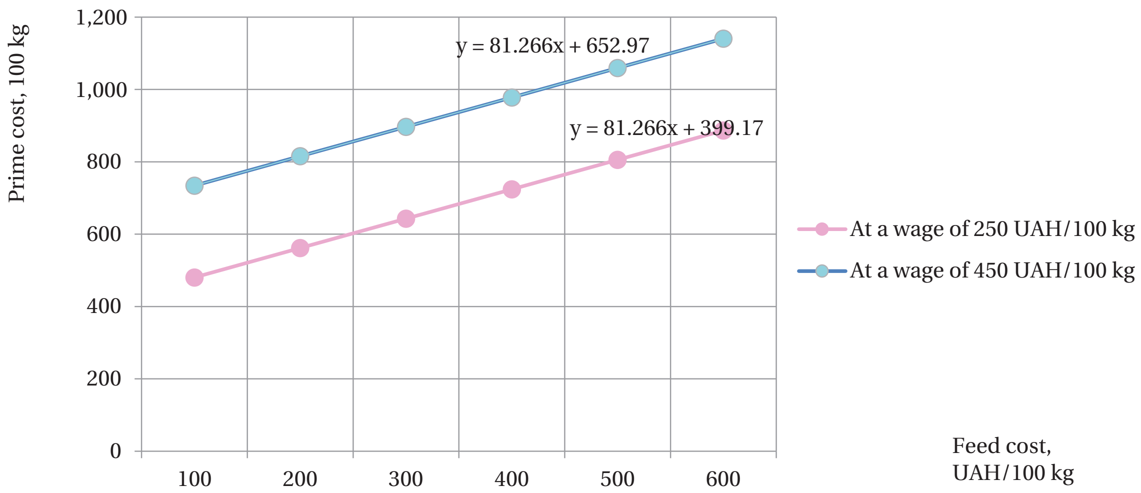

Figure 3. Dependence of milk production cost on feed cost according to the planned labour remuneration variants
Note: the function y=81.266-x+399.17 was obtained at a labour remuneration of 250 UAH/100 kg; the function y=81.266--x+652.97 was obtained at a labour remuneration of 450 UAH/100 kg
Source: compiled by the authors of this study

Thus, the use of regression dependence of the cost of livestock production on production conditions will allow obtaining the cost of milk production for any value of resource consumption for production, as well as a comparative economic assessment of the dynamics of the impact of the consumption of certain types of resources on production indicators.

In the study of optimisation methods in agriculture, G.C. Lomte & S.R. Dhavale (2022) developed a farm model using linear programming to determine the best combination of seasonal crops, their distribution in different seasons to increase production. In solving these problems, a linear programming model is used to optimally allocate limited resources to maximise farm profits. The purpose and methods of the cited study were the same as in the present study, but the objects of optimisation are different: the crop and livestock sectors.

R. Skrynkovskyy *et al.* (2022) proposed a multiplicative criterion for the effectiveness of innovation risk management in the task of maximising the enterprise's profit, considering, apart from methods for assessing the functions and parameters of the economic, environmental, and social criteria of the system for ensuring sustainable development, the methods for determining the indicator of the quality of enterprise development, as well as methods of enterprise management as a system for obtaining a type of development under the influence of a type of innovation. Thus, the authors' study has an analogous purpose, but uses both different methods and a more general object of study.

Y. Kharchenko (2021) analysed the statistical data of agricultural enterprises in the Poltava region, specifically, the author identified several influential factors and proposed to perform a regression analysis in the development of a linear multifactorial model and obtain an adaptive model to find the best forecast model of production volumes. Thus, the researcher also used regression analysis for the forecast model, but to determine production volumes, not production costs, as in the present study.

B. Noeldeke *et al.* (2022) compares several decision-making approaches to the transition of smallholder farmers to agroforestry, and creates a simulation model for rural Rwanda based on data from a socio-economic survey of smallholder farmers on the adoption of agroforestry. The modelling results show that decision-making based on the theory of rational choice and the econometric approach should be based on the criteria of maximum profit and sales revenue, It was suggested that model developers substantiate the approach to decision-making in the issues of enterprise economics based on maximum compliance with real processes and considering undiscounted and discounted profit maximisation. The conclusions drawn regarding the choice of scientific approaches to solving the tasks set coincide with the approaches used in the present study.

S. Nuzhna& N. Samarets (2018) confirmed the effectiveness of the use of economic and mathematical methods in assessing both the resource potential of agricultural enterprises and optimising the volume of product sales, and modelling agricultural production provides management opportunities at different stages of the enterprise's functioning. In contrast to the one proposed in the present study, the authors optimise production in household farms and propose regression modelling.

In analogous studies conducted by V. Zhmudenko & R. Lishchuk (2021) created a model of an optimised combination of resources to achieve maximum profit of a limited liability company with limited resources, but the authors of this study developed models with a more detailed analysis of economic indicators and predictive modelling based on regression analysis.

Summarising the review of the conducted studies, it can be concluded that the recommendations for optimising the production of farms by means of economic and mathematical modelling of the best production structure and regression modelling of production costs depending on changes in resource costs are relevant for practical use.

Conclusions

According to the purpose of this study, scientific and practical recommendations for optimising the production activities of farms were developed based on modelling optimised sales volumes and forecasted indicators of their cost. A structural model and a flowchart of the model of optimisation of the resource potential of farming were developed. An optimisation solution for achieving the maximum income of UAH 100,880 (an increase of almost 20%) by a producer was found on the example of livestock production in a household farm in the Menskyi district of Chernihiv region.

Considering the optimisation criterion and the model's constraints on the volume of resources, the coefficients of the system of equations of the numerical detailed mathematical model of the problem were determined following the performance indicators of the enterprise in terms of output and provision with individual resources. The modelling found that the maximum income can be obtained by redistributing the production volumes of certain types of products and, accordingly, the resources for their production, considering the standard costs of production per unit of product, prices for products and resources. The more than 1.5-fold increase in profit and profitability achieved is evidence of a considerable increase in business efficiency.

The study offered modelling of indicators of agricultural production according to methods of regression analysis. The study considered the modelling of regression dependencies of the cost of milk production on the cost of feed, labour costs, wages, and the number of cows based on the business results of household farms. The graphical dependencies of the cost of milk production in a household farm on the cost of feed at fixed labour costs were constructed. Regression analysis was used to determine the impact of the consumption of certain types of resources on the cost of milk production. The developed economic and mathematical models ensure the achievement of minimum production costs and maximum income from the sale of products and, as a result, increase the economic efficiency of the economic activity of the farm. Prospects for further research, considering the global processes of digitalisation and digital transformation of economic sectors, are the development of decision support systems based on economic and mathematical methods of modelling and system optimisation of technical and technological solutions.

Acknowledgments

None.

Conflict of Interest

The authors of this study declare no conflict of interest.

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Оптимізація виробництва та моделювання собівартості продукції в селянських господарствах

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▸ **Анотація.** Важливим напрямом підвищення економічної ефективності діяльності сільськогосподарських підприємств, особливо в умовах воєнного стану, є оптимізація виробництва та використання ресурсного потенціалу. Метою досліджень була розробка науково-практичних рекомендацій щодо оптимізації виробничої діяльності селянських господарств. В дослідженні використано методи: системного аналізу та синтезу при визначенні резервів задіяних видів ресурсів, економіко-математичне моделювання і оптимізації для визначення оптимальних рішень, аналітично-розрахунковий метод – в розрахунках показників виробництва продукції, кореляційно-регресійний аналіз при визначенні залежності собівартості виробництва молока від витрат ресурсів, графічний метод та екстраполяції для знаходження значень функції регресії. Виявлено основні етапи та особливості побудови економіко-математичної моделі оптимізації ресурсного потенціалу підприємства. З використанням моделі проведено аналіз даних, виявлено резерви ресурсного потенціалу, знайдено оптимізаційне рішення з обсягів реалізації продукції із застосуванням засобу електронних таблиць «Пошук рішення», прийнято стратегію підвищення економічної ефективності виробництва. Запропоновано до практичного використання економіко-математичне моделювання оптимальної структури виробництва селянського господарства, що враховує наявні виробничі ресурси. В результаті моделювання визначено, що максимальний дохід можна отримати шляхом перерозподілу обсягів виробництва певних видів продукції і, відповідно, ресурсів на їх виробництво з урахуванням нормативних витрат на виробництво одиниці виду продукції, цін на продукцію і ресурси. З використанням моделювання отримано регресійну залежність собівартості молока, виробленого в особистих селянських господарствах, від вартості кормів, витрат праці, оплати праці, чисельності поголів'я корів. Визначено величини впливу окремих видів ресурсів на собівартість виробництва та побудовано відповідні графічні залежності. Практичною цінністю результатів роботи є можливість використання викладених рекомендацій безпосередньо членами селянських господарствах в процесах планування, організації виробничої діяльності та оптимізації використання ресурсного потенціалу

▸ **Ключові слова:** оптимізація структури виробництва; моделювання; регресійний аналіз; виробничі ресурси; особисте селянське господарство