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FORECASTING PARAMETERS OF FARM DEVELOPMENT AT THE REGIONAL LEVEL USING THE STELLA PROGRAM

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Abstract
Given the importance of forecasting the production of agricultural products by farms, the study created an original model in the STELLA program, which identified the impact on the number of agricultural enterprises, land area and fertilizers. The created model showed that in Ivano-Frankivsk region by 2030 with the stabilization of the number of agricultural enterprises, land area and the increase in mineral fertilizers per hectare of sown area may increase agricultural production by farms. This will help solve important issues for the region and the state in general, related to strengthening food security, ensuring the social development of rural areas. The prognostic changes in the volume of agricultural production determined by the STELLA program by farms of the region until 2030 can be the basis for the development of a promising model of the agricultural production system at the regional level.

Keywords: *farms; prognostication; Ukraine; small agrarian business; economic competition.*
JEL Codes: *C59, O12, Q12.*

Introduction

Farms in Ukraine are an important category of small agricultural enterprises that perform a number of important economic and social functions. They contribute to the fuller use of productive resources of the agricultural sector of the economy, expand the supply of agricultural products in range and forms of promotion to consumers, create competition in the system of agricultural production, promote the preservation of rural settlements and others. The activity of farms as small subjects of agrarian business in Ukraine is based on the principles of: free choice of activities, independence in economic activity, voluntary

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involvement of resources of legal entities and individuals under current legislation, employment, free disposal of net income and full responsibility for the results of their activities (Spaskyi, 2019); (Shpykuliak and Bilokinna, 2019). The basic foundations of development of farms are: optimization of the main kinds of economic activity for the purpose of rational use of components of resource potential; satisfaction of consumer demand in agricultural products and food of all categories of the population; efficient use of agricultural lands on the basis of gradual improvement of agricultural culture; ensuring maximum employment of household members and hired labor (Svynous et al., 2020).

Small farms are significantly inferior in many performance indicators to large enterprises that are able to accumulate significant financial and material resources. Farmers cannot fully use modern innovative technologies due to the long payback period in small farms (Petrunenko et al., 2021). Therefore, L. Hnatyshyn (2021) states that "the issue of farms is perceived by many social groups only as a factor that hinders the civilizational development of the state, as well as an unnecessary financial burden for the economy." However, N. Stupen, L. Dudych, H. Dudych (2020). note that the rapid growth of total production by farms indicates that they are trying unsuccessfully to find their plase in the system of agricultural production in Ukraine. I.V. Zhurakovska, R.V. Sydorenko, T.O. Shmatkovska, I.I. Brodska (2020) argue that the world experience played an important role in the formation of farming in Ukraine, because the main form of agriculture in developed countries are small family farms.

Scenarios and problems of farm development similar to Ukraine are observed in other neighboring countries. In particular, Romanian farms are also small and have reduced the number of cattle, pigs and poultry. A. Popescu (2021) notes that the decrease in the number of small farms in this country determines the importance of research and forecasting the results of their activities.

The Government of Ukraine understands the important role of farms in solving problems of socio-economic development of the country and rural areas. Therefore, a number of targeted programs to support this category of agribusiness entities are being implemented at the national and regional levels. So, it is important to assess the effectiveness of these programs and forecast the main indicators of farm development in Ukraine and individual regions.

Research and forecasting of the parameters of farming development in the regional dimension is relevant, given the significant variation of natural, climatic and socio-economic conditions for the development of agrarian business in some regions of Ukraine. To solve this problem, it is promising to apply the methodology of system dynamics using STELLA as a special program of economic modeling. It is worth noting that models based on dynamics in the STELLA program are actively used abroad, for example, in the United States and European countries (Balali and Viaggi, 2015), (Bertalanffy, 1976), (Forester, 2003), (Richmond, 2001). In Ukraine, modeling using the STELLA program is gradually being used in the study of processes occurring in agriculture. The prognostic data obtained with the STELLA program are confirmed in the studies of the authors (Balaniuk et al., 2019), (Savka, 2020), (Shelenko, 2021). French scientists propose a large but insufficiently internationally studied model of group farming (Groupement Agricole d'Exploitation en Commun), in terms of land area, labor and capital, which with the help of group cooperation of farmers could take root in other countries if it is modified depending on from the context (Bina and Bruno, 2019). G.N. Falconnier, K. Descheemaeker, B. Traore, A. Bayoko, K.E. Giller (2018) emphasize that it is the development of farms that has been crucial in assessing Southern Mali's way out of poverty. According to J.K. Clark, D.K. Munroe, B. Mansfield (2010), regionalization is proposed as a solution to the problems faced by farmers in the globalized food system because the "region" simultaneously provides space for development of farms and limits opportunities for their adaptation.

The aim of the article is to present the methodology and results of forecasting the

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performance of farms in Ivano-Frankivsk region of Ukraine applying simulation in the STELLA program, which demonstrate the possibilities of using this program to study processes in agricultural production.

Research and methods

To predict the parameters of farm development in a particular region, it is possible to use the STELLA program, in which it is advisable to distinguish several stages. At the initial stage of application of this program it is necessary to determine: stages of forecasting the possible dynamics of performance and purpose, taking into account the available capabilities of the program, outline tasks, determine the algorithm and verify the software, as well as statistical data.

The next stage will include the direct implementation of forecasting performance indicators, in particular: setting goals for the system; determining the sequence of forecasting; analysis of standardized deviations for the dependent variable; testing using software; creation of a prognostic regression equation; creating code in the STELLA program; organization of program interaction; determination of operation parameters.

The STELLA computer program contains statistics collected for farms in Ivano-Frankivsk region (from 1992 to 2018), which were first processed in the statistical program Statistics12.

When creating a model in the STELLA program, the user forms only the design of the model, and the modeling algorithm and the program are created automatically. Creating a system model takes place on two levels: visual and mathematical equations. The presented example will allow to optimally investigate the process of receipt of these farms and will ensure the creation of strategic plans for their development.

At the mathematical level, the models of system dynamics are systems of finite-difference equations, which are solved on the basis of a numerical algorithm of integration with a constant DT step and given initial values. The formation of the model by the method of system dynamics is carried out with the help of causal diagrams. Charts determine the relationship between variables and are marked graphs.

The final stage includes graphical display of forecasting results, predicting of verification data, application of forecasting counsequences in the STELLA program, evaluation of research results.

Simulation and multi-vector study of scenarios for further development of farms is important for public authorities, which are trying to form an optimal model of the agricultural sector of the economy, taking into account the needs of food security and socio-economic development. The application of system dynamics models provides important information for the farms themselves and their associations, as it indicates the expected parameters of their development that can be achieved under certain conditions. The forecast results obtained with the help of STELLA program, as well as the dependence of the parameters of farm development at the regional level on a number of factors will contribute to the deepening of methodological experience in the field of modeling, using system dynamics approaches. The use of typical elements processed in the STELLA program (Stock, Flow, Converter, Action Connector) allows you to quickly and accurately build an economic model of the process under study.

Research results and discussion

As an indicator of the performance of farms in the study region (Ivano-Frankivsk region) used the volume of agricultural production at constant prices in 2010. The application of this cost indicator makes it possible to compare the total amount of agricultural products manufactured by farms in different years. The dynamics of total production reflects the trend of development of farms, changes in the system of agricultural production in general. The influence of a

number of factors that reflect the resource provision of farms on the formation of this effective feature was considered.

The task of projected assessment of agricultural production by agricultural holdings requires detailed elaboration and verification of information on the principles and mechanisms of functioning of these farms as a part of the system of agricultural production.

The volume of agricultural production by farmers depends on many factors (Hussayn et all., 2020), (Glazyrin et all., 2018), (Farid et all., 2021), (Yakubiv et all., 2019). We agree with J. Droždz, V. Vitunskienė, who point out the importance of analyzing data on the area of agricultural land and the production of agricultural products in the study of farm activities (Droždz and Vitunskienė, 20217).

Having selected those factor features whose influence on the resultant trait is the most noticeable, we can proceed to an in-depth study of this influence. Finding out the possibilities of adjusting the indicators – characteristics of the factor features is important when developing strategies for the development of farms in the region.

The statistical program Statistics 12 was used in the process of forecasting agricultural production. The application of this program allows to reliably generate forecasting results that are in demand in the short and medium term and allows you to compare variables measured during the experiment. With the help of "Advanced Models and General Regression" (Blahun and Blahun, 2020), (Savka, 2020) it is possible to identify different types of relationships between variables, as well as to assess their statistical significance in the research process.

The following steps defined the "Import selected sheet to a Spreadsheet", which made it possible to start inserting a data sheet into the statistical program Statistics 12.

The established system of import of the selected sheet provides high-quality performance of the tasks set before the program.

After specifying elements such as "Get vaiable names from first row" and "Get case names from first column", a data table will open, for which we select "Advanced Models" and 'General Regression" (Figure 1). For forecasting, it is important to indicate the method of selecting names from the data table in Statistics 12, as this allows you to analyze the development of farms and determine which of the factors have the greatest impact on the formation of agricultural production.

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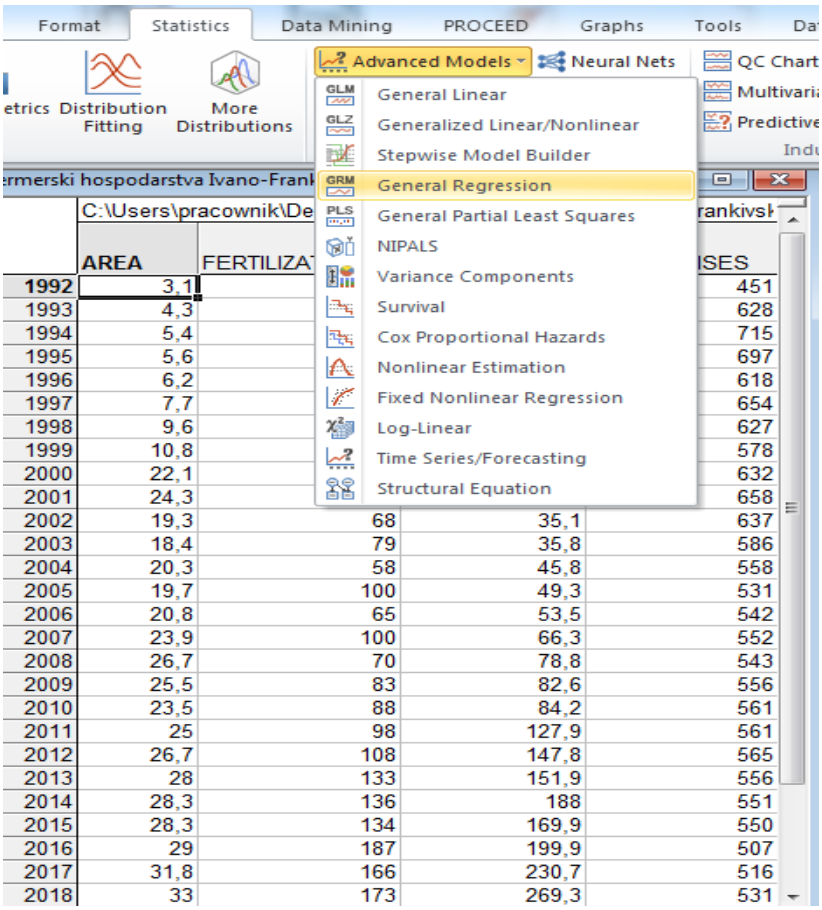

	AREA			
1992	3,1			451
1993	4,3			628
1994	5,4			715
1995	5,6			697
1996	6,2			618
1997	7,7			654
1998	9,6			627
1999	10,8			578
2000	22,1			632
2001	24,3			658
2002	19,3	68	35,1	637
2003	18,4	79	35,8	586
2004	20,3	58	45,8	558
2005	19,7	100	49,3	531
2006	20,8	65	53,5	542
2007	23,9	100	66,3	552
2008	26,7	70	78,8	543
2009	25,5	83	82,6	556
2010	23,5	88	84,2	561
2011	25	98	127,9	561
2012	26,7	108	147,8	565
2013	28	133	151,9	556
2014	28,3	136	188	551
2015	28,3	134	169,9	550
2016	29	187	199,9	507
2017	31,8	166	230,7	516
2018	33	173	269,3	531

Figure 1. In the Statistics tab, select "Advanced Models i General Regression"

**Source: developed by the authors.*

The Advanced Models data table defines the state space of the object's behavior data, and state graphs can be used to specify discrete behaviors of objects of any complexity (Sokolovska, 2018).

Then select "Polynomial regression" and specify the variables (Variables), where: variable dependent PRODUCTION (volume of agricultural production, million UAH) and independent variables AREA (area of agricultural land, ha), FERTILIZATION (application of mineral fertilizers per 1 hectare of sown area) in kilograms of active substance) and ENTERPRISES (number of farms) (Savka, 2020) (Figure 2).

The obtained results of statistical analysis can be found in the All-effects tab. The results of the analysis are clearly reproduced in the form of a drop-down window "All effects" in the program Statistics 12.

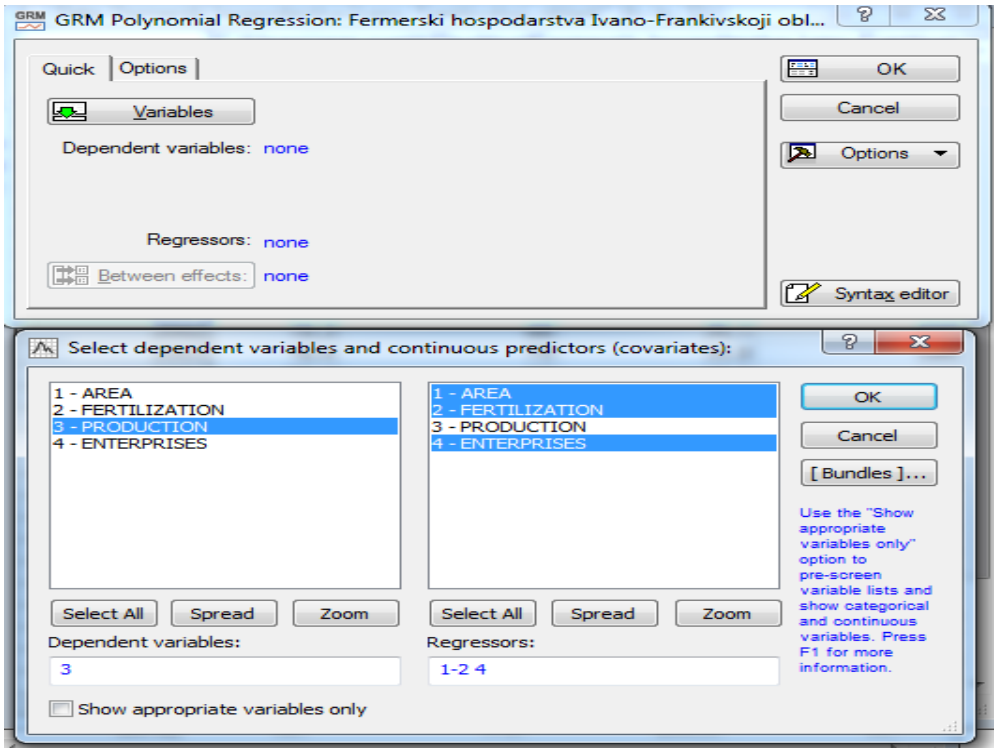

Figure 2. Selecting the dependent variable PRODUCTION and the independent variables AREA, FERTILIZATION and ENTERPRISES in Statistics 12

**Source: developed by the authors.*

These results are the results of regression analysis of the variable dependent PRODUCTION (volume of agricultural production at constant prices). We see almost zero values of P in the results of regression analysis for the dependent variable PRODUCTION (Figure 3).

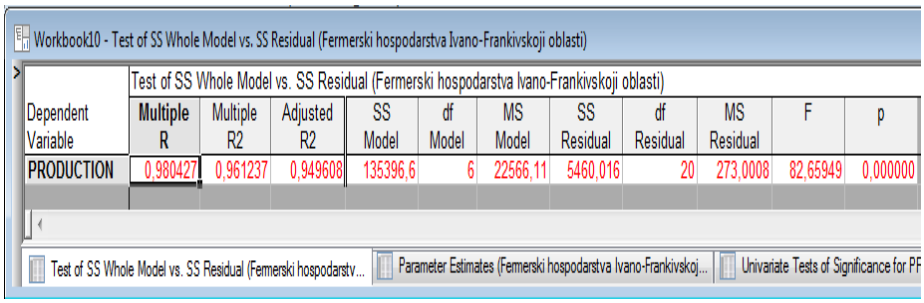

Figure 3. Results of regression analysis in Statistics 12 variable dependent PRODUCTION

**Source: developed by the authors.*

When evaluating the Beta indicator, it was proved that the following have a high impact on the formation of agricultural production volumes (PRODUCTION): the area of agricultural land used by farms (AREA), in second place such variables as ENTERPRISES – the number of farms, the third – FERTILIZATION – application of mineral fertilizers per 1 ha of sown areas in farms.

In order to analyze the standardized deviations in the Residuals 1 tab, select “Standardized” and select "Case no & res”.

Analysis of standardized ends for the dependent variable showed a lack of values greater than ± 3 sigma (Figure 4), which indicates a lack of significant data deviations.

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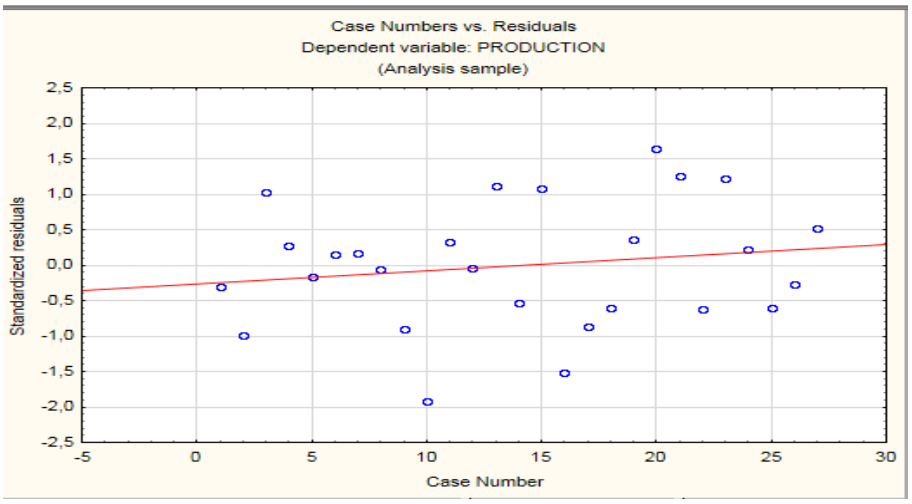

Figure 4. Placement of standardized deviations for the dependent variable PRODUCTION

**Source: developed by the authors.*

The introduction of graphical methods of systematic modeling of management processes will contribute to the visual support of farm processes.

It should be noted that in the framework of processing the collected data, the analysis of dependent variables was carried out in order to exclude cases that could violate the established regression equation. In the end, after excluding insignificant samples, regression equations were determined, parts of which were all variables (factors) that influenced the studied variable. All factors were tested for the probability test p <0.05 to exclude those that showed a lack of statistical reliability. After statistical processing of the collected data, a mathematical equation is obtained, which characterizes the relationships that occurred between the selected parameters.

To form the prognostic equation, use the "Print prediction equation to Report window". Carrying out testing with the help of software allows for further analysis of research results. The prognostic regression equation created in Statistica 12 looks like this (Figure 5). In order to insert the equation into the STELLA program, commas have been changed to dots, and quotation marks have been removed next to the names of all variables.

After that, the equation looked like this:

Prediction equation for: PRODUCTION =-304.298371964-9.11635371231 *AREA+0.379945723487*AREA^2+0.99730 4574918*FERTILIZATION-0.000775778098882*FERTILIZATION^2+1. 03221704495* ENTERPRISES -0.000870400420333*ENTERPRISES^2

This equation was inserted into the INFLOWS PRODUCTION element in STELLA.

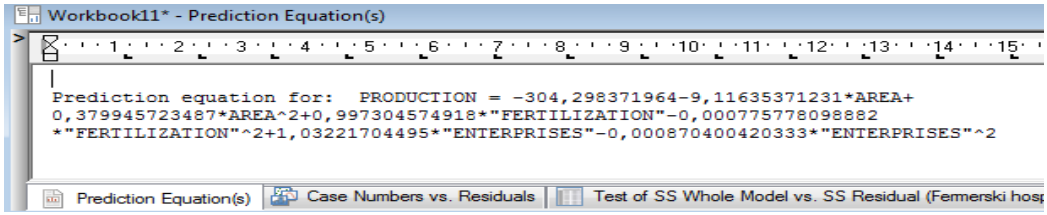

Figure 5. Predictive equation created in Statistics 12

**Source: developed by the authors.*

The model uses the graphical function "Graphical Function". STELLA graphical elements such as Graph Pad and Tabel Pad, which show forecast results, has been used. A detailed description of the STELLA program interface and methodology is disclosed in (Kozak and Parpan, 2009).

The model includes data on the activities of farms in Ivano-Frankivsk region since 1992. Information for 2018 was used only to verify the created model. That is, the results of the forecast for 2018 were compared with real statistics for this year. After verification of the model, a forecast of possible changes in the studied parameters by 2030 was made.

Figure 6 shows a block diagram of the model. The relationships between variables are designed as graphical functions in STELLA. The convenience of this method is that you can change the appearance of the function directly on the computer screen with the mouse cursor. We see the rectangle PRODUCTION created in the model in the form of stock (Stock) for agricultural products (UAH million). This stock is replenished with FLOW PRODUCTION with a feedback arrow via the PRODUCTION RATE converter. PRODUCTION is affected by 4 Converters (FERTILIZATION, AREA, ENTERPRISES, PRODUCTION RATE) via FLOW PRODUCTION. To the right is a Graph Pad element called GRAPH of FORECASTING and a Table Pad element called TABLE of FORECASTING (Savka, 2020). The following steps, which will be key to the evaluation, should then be implemented.

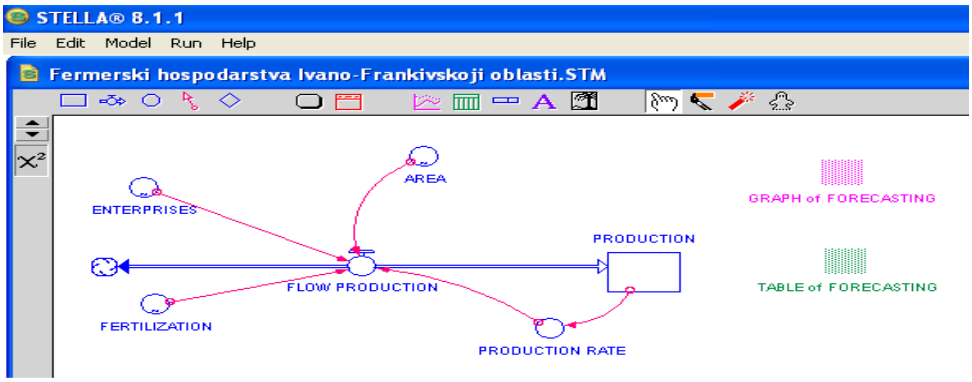

Figure 6. The interface of the created model in the STELLA program

**Source: developed by the authors.*

As noted, the verification of the model was to compare the real data of 2018 with the projected data. We see that the results of the forecast by 98-99 % coincided with the real data. Thus, in 2018 the real data for the variable PRODUCTION amounted to UAH 269.3 million, for FERTILIZATION – 173 kg of active substance per 1 ha, for AREA – 33.0 thousand ha, for ENTERPRISES – 531 farms. Accordingly, the model showed (Figure 7) in 2018 – for the variable PRODUCTION (volume of agricultural production at constant prices in 2010) – 269,601 million UAH, for FERTILIZATION – 171 kg of mineral fertilizers per 1 ha of sown area in the active substance, for the variable AREA – 32,800 hectares, for the variable ENTERPRISES – 535 farms. These data are highlighted in the figure and show the values of the parameters for PRODUCTION, AREA, ENTERPRISES, FERTILIZATION as of 2018 for the additional line, which is visible in the figure between 2011 and 2020. We have the opportunity to specify data from any year with additional vertical line highlighting the selected year, and consider the values of the analyzed parameters in this year.

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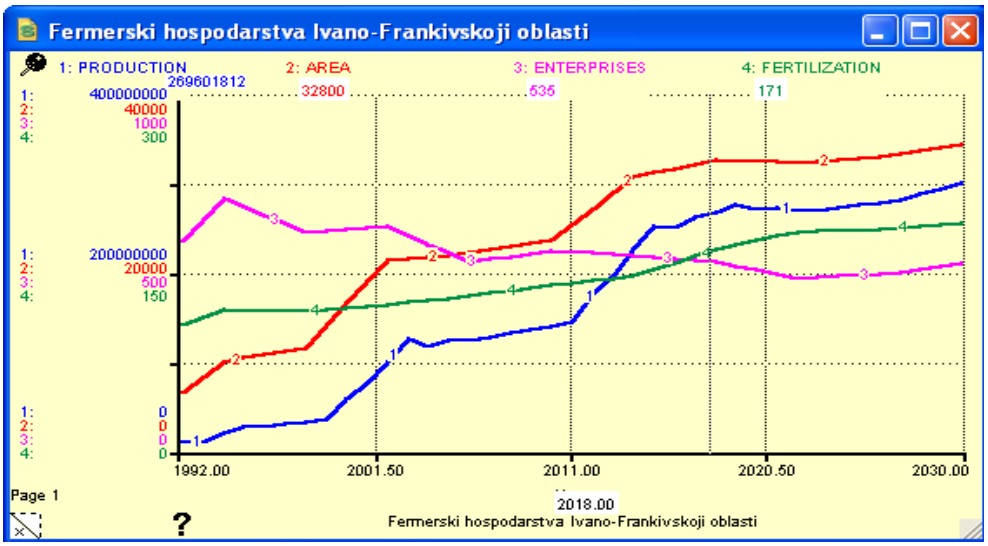


Figure 7. Graphical display of forecasting results in the STELLA program

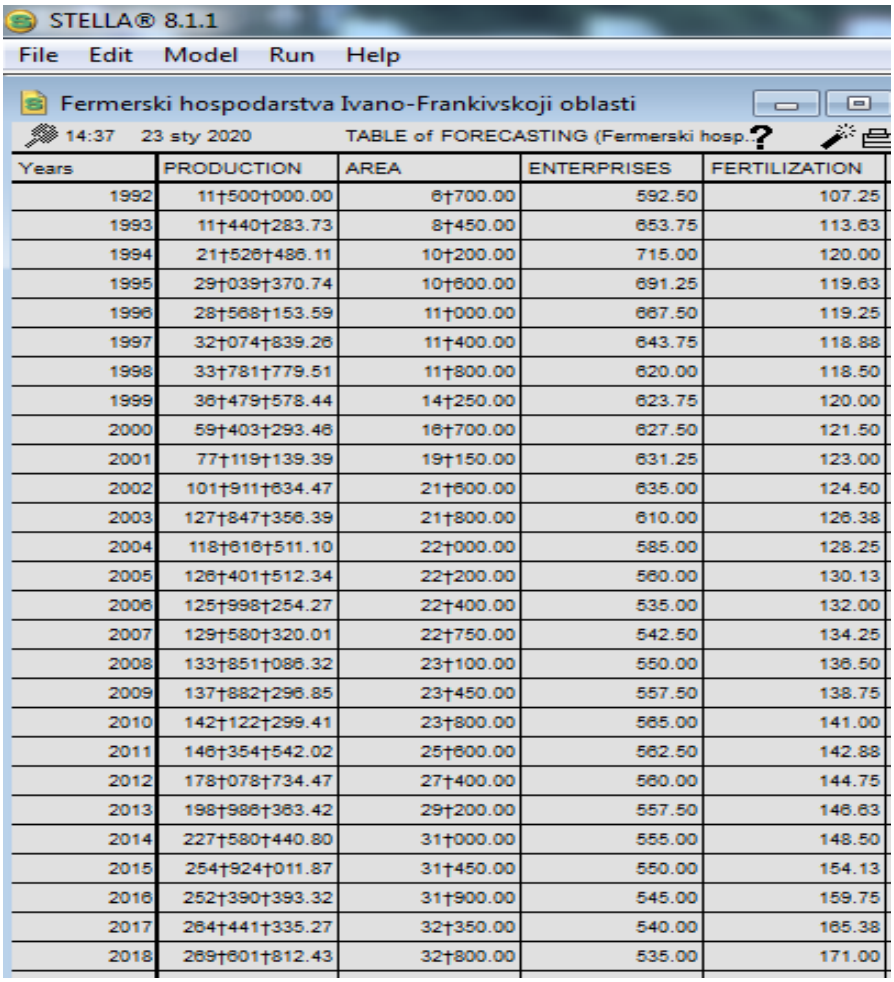
1. The volume of production of agricultural products by farms at constant PRODUCTION prices
2. AREA area of agricultural land
3. Number of ENTERPRISES farms
4. Mineral fertilizers were applied per 1 hectare of FERTILIZATION sown areas.

**Source: developed by the authors.*

The figure on the left shows the scale for each of the analyzed indicators: 1 (PRODUCTION) can vary from 0 to 400 000 000 hryvnias (in 2010 prices), 2 (AREA) can change from 0 to 40 000 ha, 3 (ENTERPRISES) can vary from 0 to 1000 enterprises, 4 (FERTILIZATION) can vary from 0 to 300 kilograms of fertilizer per 1 ha of sown area.

Each line on the chart has its own number. For example, the production volume of agricultural products at constant prices (PRODUCTION) is number 1. Accordingly, the area of agricultural land (AREA) is number 2, the number of farms (ENTERPRISES) – number 3, and fertilizer application in the active substance per 1 hectare of sown area (FERTILIZATION) – number 4.

The results of the forecast (Picture 8) showed a possible increase in the production of agricultural products in Ivano-Frankivsk region at constant prices (PRODUCTION) with an increase in the amount of mineral fertilizers per 1 ha of sown area (FERTILIZATION) and the area used by farms (AREA). At the same time, no significant changes are expected in the number of farms operating in the field (ENTERPRISES).



STELLA® 8.1.1

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Fermerski hospodarstva Ivano-Frankivskoji oblasti

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Years	PRODUCTION	AREA	ENTERPRISES	FERTILIZATION
1992	11†500†000.00	6†700.00	592.50	107.25
1993	11†440†283.73	8†450.00	653.75	113.63
1994	21†526†486.11	10†200.00	715.00	120.00
1995	29†039†370.74	10†600.00	691.25	119.63
1996	28†568†153.59	11†000.00	667.50	119.25
1997	32†074†839.26	11†400.00	643.75	118.88
1998	33†781†779.51	11†800.00	620.00	118.50
1999	36†479†578.44	14†250.00	623.75	120.00
2000	59†403†293.46	16†700.00	627.50	121.50
2001	77†119†139.39	19†150.00	631.25	123.00
2002	101†911†634.47	21†600.00	635.00	124.50
2003	127†847†356.39	21†800.00	610.00	126.38
2004	118†616†511.10	22†000.00	585.00	128.25
2005	126†401†512.34	22†200.00	560.00	130.13
2006	125†998†254.27	22†400.00	535.00	132.00
2007	129†580†320.01	22†750.00	542.50	134.25
2008	133†851†086.32	23†100.00	550.00	136.50
2009	137†882†296.85	23†450.00	557.50	138.75
2010	142†122†299.41	23†800.00	565.00	141.00
2011	146†354†542.02	25†600.00	562.50	142.88
2012	178†078†734.47	27†400.00	560.00	144.75
2013	198†986†363.42	29†200.00	557.50	146.63
2014	227†580†440.80	31†000.00	555.00	148.50
2015	254†924†011.87	31†450.00	550.00	154.13
2016	252†390†393.32	31†900.00	545.00	159.75
2017	264†441†335.27	32†350.00	540.00	165.38
2018	269†601†812.43	32†800.00	535.00	171.00

Figure 8. Verification data display forecast from 2018

**Source: developed by the authors.*

Thus, the model predicts (Figure 9) that by 2030 the total number of farms in Ivano-Frankivsk region will not change significantly. This number may fluctuate, because, on the one hand, in recent years in the region a significant number of registered farms (up to a third) were not economically active, did not reflect the results of economic activities (Savka, 2020). On the other hand, the transformation of the most developed personal peasant households into family farms is expected. To ensure the process of such transformation in Ukraine, the necessary legal framework has been created, and certain state support has been declared. The process of transforming personal peasatn households into farms has not yet reached a significant scale, so it is quite realistic that the STELLA program predicts a slight decrease in the number of farms in the Ivano-Frankivsk region in the coming years, which will change in the long run. Along with the revival of the process of creating new farms, we should expect an increase in the number of businesses that cease operations.

A certain increase in the area of agricultural land used by farmers is projected. This growth is relatively small, given the fierce competition between agricultural enterprises for the right to use land resources. The problem of raiding, related to the seizure of land used by farmers, is also acute for Ukraine (Kuznyak, 2019). Farmers will be able to increase the area of land use due to the lease of land shares and their acquisition. The purchase of agricultural land has become possible in Ukraine since 2021. However, the main contenders for land shares for sale are considered to be large agricultural enterprises.

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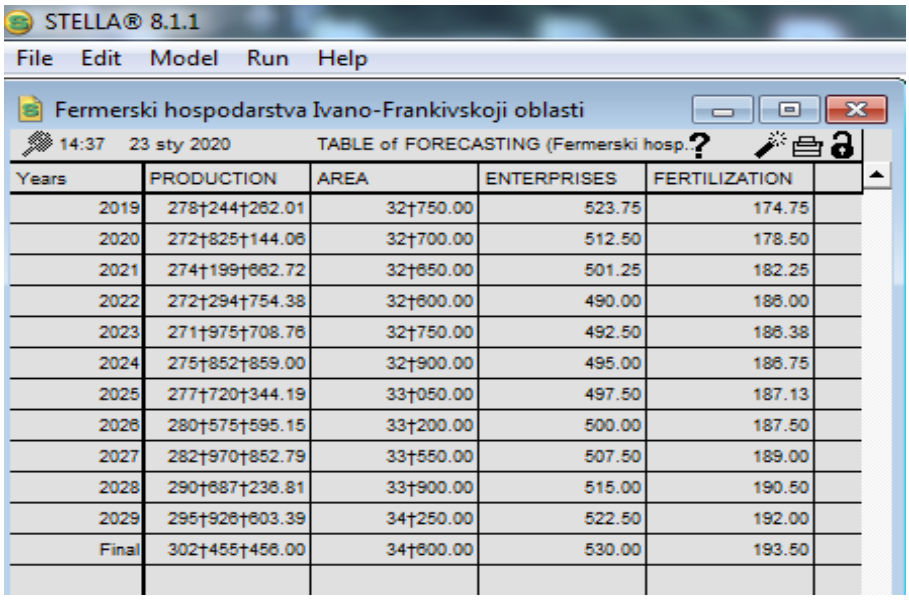

Years	PRODUCTION	AREA	ENTERPRISES	FERTILIZATION
2019	278†244†262.01	32†750.00	523.75	174.75
2020	272†825†144.06	32†700.00	512.50	178.50
2021	274†199†662.72	32†650.00	501.25	182.25
2022	272†294†754.38	32†600.00	490.00	186.00
2023	271†975†708.76	32†750.00	492.50	186.38
2024	275†852†859.00	32†900.00	495.00	186.75
2025	277†720†344.19	33†050.00	497.50	187.13
2026	280†575†595.15	33†200.00	500.00	187.50
2027	282†970†852.79	33†550.00	507.50	189.00
2028	290†687†236.81	33†900.00	515.00	190.50
2029	295†926†603.39	34†250.00	522.50	192.00
Final	302†455†456.00	34†600.00	530.00	193.50

Figure 9. Display of forecasting results from 2018 to 2030 in the STELLA program

**Source: developed by the authors.*

The rather modest financial capabilities of farmers limit the prospects for a significant increase in the area of land they use.

The main income of farms in Ivano-Frankivsk region comes from the sale of crop products. The volume of its implementation is largely determined by the yield of agricultural crops, an important factor in the formation of which is the number of applied per 1 hectare of mineral fertilizers. Practice shows that the level of fertilizer application is quite closely correlated with other agro-technological factors – the use of plant protection products, seed quality, etc., so it can serve as an indicator of intensification of crop production by farmers. Farmers' use of mineral fertilizers is projected to increase, but this will be limited by the difficult financial situation of small agricultural producers.

Despite the existing difficulties, the farms of Ivano-Frankivsk region achieve the projected growth of agricultural production at constant prices in 2010 (up to more than UAH 300 million in 2030) is possible given the following circumstances:

- the availability of farms with significant reserves to increase the yield of major crops through the improvement of production technologies;
- the existence and preservation in the long run of sufficient demand for crop products produced by farms, ie, the volume of products manufactured by farmers will be limited not so much by customer demand as by the resource capabilities of farmers themselves;
- opportunities to diversify the activities of farms that demonstrate the ability to respond flexibly to market demands, target groups of consumers, and one of the promising options for diversification is the development of organic agricultural production;
- availability of targeted support programs for farms at the national and regional levels, which facilitate farmers' access to credit resources and other sources of funding, allow them to strengthen the material and technical base, modernize production;
- solving problems of resource provision of farms, organization of sales of their products through cooperation and other forms of integration relations with business partners;
- increase the efficiency of farmers' management decisions through their cooperation with advisory services established in the region.

The considered example of the applied economic model executed by means of the

STELLA program showed it as rather accessible, transparent and clear. The obtained graphic results are important for the development of methods of economic research with the use of modern computer programs. Modeling based on statistical data of given parameters can increase the production and presentation of research results in the form of equations and numbers and determine the prospects for improving the future efficiency of farms.

For the proposed forecast model of farm development, the basics of modeling were used, which allowed to ensure the reflection of the state and conditions of their activities. An effective indicator of their economic activity - the volume of agricultural production, calculated in value terms using constant prices, allows to assess the place of farms in the agricultural production system of the region. It can be used to determine a number of indicators of the efficiency of farms. The parameter (PRODUCTION) predicted in the model shows the increase in the volume of agricultural production by farmers of Ivano-Frankivsk region by 2030.

The forecast shows that farms in Ivano-Frankivsk region will remain a less important segment of the regional system of agricultural production over the next decade. The share of agricultural autput produced by them will not exceed 6-7% of the total volume of its production by all categories of farms. Farms should not be seen as a substitute for large agricultural enterprises. At the same time, the very fact of the existence of farms demonstrates the existence of a certain alternative to the high concentration of production, which has been observed in recent years in Ukraine, and low-income and inefficient farms.

Conclusions

Farms in Ukraine show a positive dynamics of agricultural production, which reflects their ability to find profitable niche markets. The development of these farms is of great social and economic importance. However, their contribution to the formation of the supply of agri-food products in Ukraine and its individual regions remains relatively small. Assessing the current situation and substantiating strategic plans for agricultural development requires studying the development trends of farms and clarifying its expected results. To this end, multidimensional methods can be used to predict the basic parameters of the functioning of farms, in particular the system dynamics program STELLA.

The application of the STELLA program for forecasting the performance of farms in a particular region makes it possible to take into account the regional specifics of the agricultural production system. The forecast of the development of farms in Ivano-Frankivsk region showed that a certain increase in agricultural production should be expected. Positive dynamics will be ensured by increasing crop yields with a small increase in the area of land used by farmers.

The increase in productivity, in turn, will be the result of further improvement of crop production technologies, which is an important element of innovative development of farms.

The parameters of resource provision of farms are determined, the influence of which on the formation of the final results of their activity is especially noticeable. The relationship between the studied factors and the resultant trait is based on the stable patterns of development of farms in a particular region of Ukraine. Therefore, the forecast results relate not only to the indicators of production volumes, but also to the expected scenario of development of this sector of the agricultural economy. The actual performance of farms in the coming years is likely to differ from those projected due to the crisis caused by the unexpected military aggression against Ukraine. However, after the situation normalizes, the development of the agricultural sector will be carried out according to the scenario formed over the last decade, which provides for coexistence and competition for resources of agricultural producers of different sizes.

Establishing a link between individual farm performance indicators can broaden the forecasting framework. The relatively small increase in the resource potential of farms in Ivano-Frankivsk region and their production

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volumes reflects the presence of problems in small agricultural enterprises, which find it difficult to compete with large corporate enterprises. Therefore, ensuring the further development of farms will depend on the continuation of their support programs, which were implemented in previous years in Ukraine at the national and regional levels.

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