

SECTION 4. ENTERPRISE ECONOMICS AND PRODUCTION MANAGEMENT

4.1 Modeling of the processes of adaptation of the economic mechanism of the functioning of agricultural business entities to the market

The model of adaptation of the economic mechanism of functioning of agrarian entrepreneurship entities to the conditions of institutional instability of Ukraine is obliged to refract in itself a dialectically integral set of forms and methods of survival, which reflects the mechanisms of influence of the market environment and the unity of functional relations that establish a balance in relations and ties of the market. The model of adaptation of the economic mechanism of functioning should reveal the "principles, norms and rules of the market game" with distinctive features of competitiveness; price, credit, tax, financial, organizational, production and cooperative integration relations; behavior and economic condition of subjects of agrarian entrepreneurship.

Taking into account the logical structure of our own conceptual guidelines for adapting the economic mechanism of the functioning of agrarian enterprise entities, we believe that the modeling process should involve not only the parameters and indicators of adaptation, the main components of the adaptation of the economic mechanism of functioning, but also specific functional dependencies of the equilibrium state of agrarian business entities; demand for products in the equilibrium state; survival of agrarian business entities; income dynamics; the optimal number of relations between the bank and agricultural business entities, the expected profit in the process of adaptive relations with the bank and others. The implementation of modeling involves the development of an information system, a normative assessment scale for interpreting the results in the level hierarchy, and more.

Studying the processes of adaptation of the economic mechanism of the functioning of agrarian entrepreneurship entities to the market and methods of diagnosing the adaptive state of enterprises, economists use various methodological and methodological approaches (Andriichuk V. G., Khodzitska K. R. [183],

Ivanchenko V. O. [184], Korinets R.Ya. [185], Kostyrko I. G. [186], Kravchenko S. A. [187], Lupenko Yu. O. [185, 188, 193], Malik M. Y. [185, 188, 189, 193], Malik L. M. [190], Mamchur V. A. [185, 188, 191, 192], Shpykuliak O. H. [185, 193, 194], Aliksieieva O. V. [194] and others). In the study of the mechanism of adaptation of enterprises to the environment, methods of economic dynamics, adaptive planning, models of structural adaptation, models of adaptive coordination, neural networks in adaptive systems, methods of strategic analysis in adaptive management, models of types of adaptation, a model of a viable system, a cascade approach in the mechanism of adaptation of management decisions and many others are implemented. Nevertheless, despite all the variety of approaches and methods implemented, there is no independent, specially created and universally recognized integrative system of methods for diagnosing adaptive processes in the studies of the adaptation mechanism. Research positions are of professional interest, but are not sufficiently full-fledged in the system of development of the economic mechanism for adapting agricultural business entities to market conditions.

The development of adaptation of the economic mechanism for the functioning of agricultural business entities to market conditions is the most urgent problem of the crisis economy. The use of modeling tools is an integral part of the adaptation-diagnostic system. The main methods of diagnosing adaptive processes as an integral part of the survival mechanism of agrarian business entities are not systematized, the specific actions of specialists are not synthesized and conceptually incomplete. Modeling the processes of adaptation of the economic mechanism of the functioning of agricultural business entities to market conditions allows us to identify the possibility of successful financing of the enterprise as a client, the level of adaptive relations of agrarian entrepreneurship entities with banks, the situation of refusal to finance the client, the state of the creditor, the conditions of equilibrium in the interactions between the client and the lender, and more.

The purpose of writing the article is to present and substantiate the developed model of diagnostics of the processes of adaptation of the economic mechanism of functioning of enterprises to market conditions in Ukraine. The achievement of the

goal was facilitated by general scientific methods: methods of empirical research (measurement, comparison), methods of theoretical research (analysis and synthesis); as well as local (specific) methods: methods of analyzing the situation (calculation-constructive method); methods of predictive estimation (modeling).

Diagnostics of the processes of adaptation of the economic mechanism of the functioning of agrarian business entities to market conditions consists of several stages. For example, at the preparatory stage of diagnostics by random sampling, enterprises of different organizational and legal forms of management are selected to participate in the study. A preliminary analysis of the cost of sold products of enterprises by the methods of linear programming and iterations determines the matrix of effectively operating subjects of agrarian entrepreneurship.

The application of the iteration method in solving the problem of optimizing the net profit of diagnosed subjects of agrarian entrepreneurship enriches the information analysis of the financial condition of these business entities in the process of adaptation. The objectives of the implementation of models for the development of adaptive systems and the main approaches and methods of diagnostics of domestic and foreign researchers, which are taken into account when modeling the processes of adaptation of the economic mechanism of the functioning of agrarian entrepreneurship entities, are analyzed. The second stage of diagnostics involves the development of a cybernetic model of the processes of adaptation of the economic mechanism of the functioning of agrarian business entities with the definition of the features and types of classification of the model (Table 1), the information system (adaptation of the economic mechanism; block diagrams of the implementation of the model in computer support), the normative scale for assessing indicators.

Table 1

Characteristics of the cybernetic model of the processes of adaptation of the economic mechanism of the functioning of subjects of agrarian entrepreneurship

Classification feature	Classification type
By general purpose	Applied
By degree of object aggregation	Microeconomic
For a specific purpose	Adaptive (optimization, equilibrium)
Time Factor Considerations	Dynamic
By type of approach to the studied socio-economic systems	Constructive
By type of systems studied	Stochastic

By type of mathematical apparatus used in the model	Combined
By build method	Ideal, mathematical, symbolic– symbolic
By degree of generality relative to the simulated object	Model – Interpreter
By the nature of the relationship in the model	Structural and functional
By degree of unification	Combined

Information source – own research

Cybernetic model of the processes of adaptation of the economic mechanism of the functioning of agricultural business entities to the market

$$\left\{ \begin{array}{l}
 x_j(t, \mu) = -\sigma \cdot (\ln p_j(t) - \ln q(t)), j = \overline{1, \mu} \\
 \ddot{o}_j(t, \mu) = \left(\frac{P_j(t)}{Q(t)} \right)^{-\sigma} \cdot \frac{Y^d}{\mu}, Q(t) \neq 0, \mu \neq 0; 0,4 < \sigma < 0,8 \\
 \left\{ \begin{array}{l}
 Y^d = \sum \Phi.2(p.010 + p.060 + p.110 + p.120 + p.130 + p.200) \\
 Q(t) = \left(\frac{1}{\mu} \cdot \sum_{j=1}^{\mu} P_j^{1-\sigma}(t) \right)^{\frac{1}{1-\sigma}}, \sigma \neq 1
 \end{array} \right. \\
 \dot{x}_j(t, \mu) = -\sigma \cdot \left(\frac{\ln \dot{p}_j(t) - \ln \dot{q}(t)}{\ln p_j(t) - \ln q(t)} \right) \cdot x_j(t, \mu), \dot{p}_j(t) < p_j(t), \dot{q}(t) < q(t) \\
 \xi_j(t+1) = r \cdot (\xi_j(t) - \varsigma_j(t)) \cdot \left(1 - \frac{\xi_j(t)}{\chi_j(t)} \right) + \xi_j(t), 0 < r < 1,21 \\
 \dot{\xi}_j(t+1) = r \cdot (\xi_j'(t) - \varsigma_j(t)) \cdot \left(1 - \frac{\xi_j'(t)}{\chi_j(t)} \right) + \xi_j'(t) \\
 \left\{ \begin{array}{l}
 \xi_j'(t) = \xi_j(t) + \Delta \xi_j(t) - \ddot{u}_1 \cdot \Delta \xi_j(t-2) - \ddot{u}_2 \cdot \Delta \xi_j(t-3), \ddot{u}_1 + \ddot{u}_2 = 1 \\
 \Delta \xi_j(t) = \max\{0, \xi_j(t) - \chi_j'(t)\} \\
 \Delta \xi_j(t-2) = \max\{0, \xi_j(t-2) - \chi_j'(t-2)\} \\
 \Delta \xi_j(t-3) = \max\{0, \xi_j(t-3) - \chi_j'(t-3)\}
 \end{array} \right. \\
 \dot{\beta}_j = \gamma_j \cdot \rho \cdot \beta_j \cdot \left(d_j - \sum_{j^*=1}^m \beta_{j^*} \right), j^* \neq j, 0 < \gamma_j \leq 1 \\
 \left\{ \begin{array}{l}
 d_j = \frac{\delta - \alpha_j}{\rho}, d_j > 0, \rho > 0, \delta > 0, \rho, \delta \rightarrow \max, \alpha_j \rightarrow \min \\
 n^* = \frac{\ln \psi - \ln(-\varpi \ln \vartheta)}{\ln \vartheta}, \ln \psi > \ln(-\varpi \ln \vartheta), \ln \vartheta > 0 \\
 \varpi = \int_{\frac{I_1}{v \cdot K}}^{t=1} (\tau \cdot K - I_1) f(\tau) d\tau \\
 \vartheta = \frac{\text{Активы банка}}{\text{Обязательства банка}} \cdot 100\% \\
 \pi(n) = (1 - \vartheta^n) \cdot \left(\int_{\frac{I_1}{v \cdot K}}^{t=0} (\tau \cdot K - I_1) f(\tau) d\tau \right) - (I_0 + n \cdot \psi)
 \end{array} \right.
 \end{array} \right.$$

where is: $x_j(t, \mu) = -\sigma \cdot (\ln p_j(t) - \ln q(t))$ – function of the equilibrium state of the subject of agrarian entrepreneurship in market conditions; j – an operating subject of agrarian entrepreneurship in market conditions; t – time of spatial organization in a loop; x_j – relative market share of the subject of agrarian entrepreneurship in market conditions; $x_j > 0$ – the subject of agrarian entrepreneurship j has a market share higher than the relative symmetrical equilibrium Bertrand-Nash; $\sum_{j=1}^{\mu} x_j = 0$ – the relative symmetric equilibrium of Bertrand-Nash in a market environment; $x_j < 0$ – the subject of agrarian entrepreneurship j has a market share lower than the relative symmetrical equilibrium Bertrand-Nash; σ – product elasticity; $\ln p_j(t), \ln q(t)$ – price logarithms;

$$\ddot{o}_j(t, \mu) = \left(\frac{P_j(t)}{Q(t)} \right)^{-\sigma} \cdot \frac{Y^d}{\mu} - \text{the function of demand for products in the equilibrium}$$

state of the subject of agrarian entrepreneurship; Y^d – real total income; $P_j(t)$ – the price, which is set by the agricultural business entity j at time t ; $Q(t)$ – the price of products, taking into account the elasticity of these products;

$$\dot{x}_j(t, \mu) = -\sigma \cdot \left(\frac{\ln \dot{p}_j(t) - \ln \dot{q}(t)}{\ln p_j(t) - \ln q(t)} \right) \cdot x_j(t, \mu) - \text{function of survival of the subject of}$$

agrarian entrepreneurship; $\ln \dot{p}_j(t), \ln \dot{q}(t)$ – logarithms of prices after the introduction of innovative technology by the subject of agrarian entrepreneurship;

$$\xi_j(t+1) = r \cdot (\xi_j(t) - \varsigma_j(t)) \cdot \left(1 - \frac{\xi_j(t)}{\chi_j(t)} \right) + \xi_j(t), 0 < r < 1,21, \text{ as well as the equation}$$

$$\dot{\xi}_j(t+1) = r \cdot (\xi'_j(t) - \varsigma_j(t)) \cdot \left(1 - \frac{\xi'_j(t)}{\chi_j(t)} \right) + \xi'_j(t) - \text{functions of the dynamics of income of the}$$

subject of agrarian entrepreneurship in the process of adaptation; $\xi_j(t)$ – the level of income of the subject of agrarian entrepreneurship at time t ; $\xi'_j(t)$ – income that is distributed from the reserve fund at a time of $t+2$ and $t+3$; $\varsigma_j(t)$ – the minimum level of income necessary to ensure a normal income after the sale of products; the ability to

meet the needs of their own market niche; $\chi_j(t)$ – the maximum level of excess income necessary to ensure a normal income after the sale of products; capacity of own market niche; $\chi'_j(t)$ – excess income, which is redistributed in the periods $t+2$ and $t+3$; $\xi_j(t+1), \dot{\xi}_j(t+1)$ – the level of income of the subject of agrarian entrepreneurship at a time $t+1$; $\ddot{u}_1, \ddot{u}_2$ – weighting coefficients that determine the proportions of redistributable income in periods $t+2$ and $t+3$; r – duration of the production cycle; characteristics of the method of production; economic growth rates; the time of the logistic growth process; $r > 0$ if $\varsigma_j(t) < \xi_j(t) < \chi_j(t)$;

$$\dot{\beta}_j = \gamma_j \cdot \rho \cdot \beta_j \cdot \left(d_j - \sum_{j^*=1}^m \beta_{j^*} \right), d_j = \frac{\delta - \alpha_j}{\rho} - \text{function of competitive and cooperative}$$

interaction; $\dot{\beta}_j$ – part of the profit of each of the subjects of agrarian entrepreneurship, which goes to the reproduction of products; γ_j – coefficient of competitive and cooperative interactions; β_j – volume of output by the subject of agrarian entrepreneurship j ; α_j – costs per unit of output (cost of output); ρ, δ – linear coefficients of product prices; d_j – isocles of the system of economic dynamics; $j^* \neq j$ – the condition of mutualism (the interaction between two subjects of agrarian entrepreneurship (or between an agrarian business entity and a bank) is beneficial for the development of both market agents);

$$n^* = \frac{\ln \psi - \ln(-\varpi \ln \vartheta)}{\ln \vartheta}, \varpi = \left(\int_{\nu \cdot K}^{t=1} (\tau \cdot K - I_1) \cdot f(\tau) d\tau \right) - \text{function of the optimal number}$$

of relations between the bank and the client; ψ – the amount of the loan provided by the bank for the subject of agrarian entrepreneurship; ϑ – liquidity of the bank; $t=1$ – intermediate point of time of implementation of the investment project; I_1 – secondary capital allocation or investment price in the process of project implementation; ν – share of capital from the subject of agrarian entrepreneurship for the bank at a time $t=1$; K – income from the implementation of the investment project; $\nu \cdot K$ – payment to creditors at a time $t=2$ (when the implemented investment project begins to generate

income); τ – probability of income; $f(\tau)$ – density of capital allocation; $\frac{I_1}{v \cdot K} \geq \tau$ – the probability of return on investment in the secondary distribution of capital by the bank (the probability of successful implementation of the investment project by the subject of agrarian entrepreneurship);

$$\pi(n) = (1 - g)^n \cdot \left(\int_{\frac{I_1}{v \cdot K}}^{t=0} (\tau \cdot K - I_1) \cdot f(\tau) d\tau \right) - (I_0 + n \cdot \psi) - \text{the function of the expected profit}$$

of the subject of agrarian entrepreneurship in the process of adaptive relations with the bank; n – number of banks; $t=0$ – the initial point of time of the project implementation; I_0 – initial capital allocation or investment price at the beginning of the project; $I_0 + n \cdot \psi$ – the required loan amount to cover costs at the time $t=1$; $\tau = (1 - g)^n$ – the probability that at least one bank of those with which the subject of agrarian entrepreneurship is associated is in excellent financial condition.

Based on the results of the diagnostics of the processes of adaptation of the economic mechanism of functioning, the subjects of agrarian entrepreneurship are provided with general recommendations of the "trajectory of proximal development". In addition to general recommendations, private recommendations were given to the management staff and the team of analysts of each enterprise. Proposals for the implementation of adaptation measures involve such basic components as the creditworthiness of products and the subject of agrarian entrepreneurship; tax, credit, price and financial relations; organizational-production and cooperative and integration interactions; the level of economic condition and the potential of behavior.

The third stage of diagnostics is the direct implementation of modeling. The model is legitimate in use for subjects of agrarian entrepreneurship of any organizational and legal form. Processing of modeling results involves the application of the normative assessment scale developed by us to interpret the necessary values (model parameters) in the level hierarchy of adaptation (high, medium, low) of enterprises to market conditions (Table 2). In the system of bank lending in Ukraine, in accordance with financial results, rating groups systematize the structure of assets, liabilities and equity capital, banks as enterprises.

Table 2

Normative scale, which is identified empirically and is intended to determine the level of adaptation of agricultural business entities

Feature Metrics	Levels of adaptation of the business entity to the market		
	low	average	high
$x_j(t, \vartheta)$	$x_j \triangleright 0; x_j \triangleleft 0$	$x_j \approx 0$	$x_j = 0$
$\eta_j(t, \vartheta)$	49 and below	50 – 99 – below average 100 – 149 – above average	150 and up
$\dot{x}_j(t, \vartheta)$	$\dot{x}_j \triangleright 0; \dot{x}_j \triangleleft 0$	$\dot{x}_j \approx 0$	$\dot{x}_j = 0$
$\xi_j(t+1)$	$\xi_j(t+1) \triangleleft \xi_j(t)$	$\xi_j(t+1) \geq \xi_j(t)$	$\xi_j(t+1) \triangleright \xi_j(t)$
$\dot{\xi}_j(t+1)$	$\dot{\xi}_j(t+1) \triangleleft \dot{\xi}_j(t)$	$\dot{\xi}_j(t+1) \geq \dot{\xi}_j(t)$	$\dot{\xi}_j(t+1) \triangleright \dot{\xi}_j(t)$

Information source – own research

According to the form of passive adaptation, the goals of the functioning of agricultural enterprise entities, the state of production and development trends, and the features of resource maneuvering were analyzed. According to the form of active adaptation, the efficiency of the production process was evaluated, the mechanisms for achieving the goals of the subject of agrarian entrepreneurship, diversification and reservation were adjusted.

Thus, in the course of the study, it has been established that in the conditions of market management, the use of modeling tools contributes to the prompt search for ways to improve the adaptation of the economic mechanism of the functioning of agrarian business entities to the market. In the process of modeling the processes of adaptation of the economic mechanism of functioning, the parameters, directions and forms of adaptation, the main components of the adaptation of the economic mechanism of functioning are taken into account.

The developed model of the processes of adaptation of the economic mechanism of the functioning of agrarian business entities to market conditions is effective, quite effective and is complex, systematic and universal. Prospects for further scientific developments in this direction are associated with the improvement of the model of the economic mechanism for the adaptation of agricultural business entities in market conditions; adaptive state diagnostic systems; decision-making systems to ensure competitive advantages.