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NEURO-FUZZY FORECASTING AND SCENARIO MODELING OF ENTERPRISE POTENTIAL DEVELOPMENT TAKING INTO ACCOUNT RESILIENCE

A model for forecasting the development trajectories of the company's potential has been developed by means of an adaptive neuro-fuzzy inference system, which provides interpretability of the forecast and the possibility of scenario modeling of the impact of purposeful strengthening of resilience on the future dynamics of the potential. An adaptive neuro-fuzzy inference system based on the first-order Takagi–Sugeno model with a hybrid learning algorithm (least squares method for consequent parameters and gradient descent for membership function parameters) was used. To overcome the problem of dimensionality, the reduction of the space of input variables to two key predictors with ridge regularization of consequents was applied. Model quality is assessed by coefficient of determination, RMSE, and MAPE with mandatory comparisons with baseline models. The test was conducted on panel data of 175 enterprises in five sectors for 2018–2025. A model with a transparent base of nine fuzzy rules is built, achieving $R^2 = 0.835$ and $MAPE = 9.3\%$ on the test sample. It was found that the accuracy of the model is comparable to the basic models, and its main value lies in its interpretability and the ability for scenario modeling. Scenario modeling proved that targeted strengthening of resilience can change the downward trajectory of the potential of a crisis enterprise to an upward one (from 0.350 to 0.405 on the horizon of 2028), with the largest relative effect being obtained by crisis enterprises. The model for forecasting the trajectories of the development of the company's potential has been further developed, which, unlike classic neural network models ("black boxes") and statistical extrapolation methods, combines acceptable accuracy of the forecast with interpretability through a transparent base of fuzzy rules and the ability to scenario-model management influences, primarily strengthening the resilient component of the potential. The model makes it possible to turn the forecast from a passive extrapolation of dynamics into a tool for justifying management decisions: to quantify the return on investments in resilience for enterprises of various types and to differentiate development strategies in accordance with the projected potential trajectory.

Keywords: enterprise potential, forecasting, adaptive neuro-fuzzy system, ANFIS, Takagi–Sugeno fuzzy rules, scenario modeling, resilience, development strategy.