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INTELLIGENT DECISION SUPPORT SYSTEM FOR FORECASTING THE CRISIS STATE OF AN ENTERPRISE

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Abstract. *A methodological approach to building an intelligent decision support system combining Monte Carlo simulation modeling and multi-criteria optimization for detecting enterprise crisis conditions is considered. An integral crisis index is proposed; its behavior under uncertainty is studied using the Monte Carlo method, while its correctness is confirmed by comparison with the Altman model.*

Keywords: *intelligent system, decision support, simulation modeling, multi-criteria optimization, enterprise crisis state, Monte Carlo method.*

The article addresses the problem of timely detection of an enterprise's crisis financial state under significant external uncertainty. Traditional static methods of financial ratio analysis register a crisis only after it has occurred, limiting their value for preventive decisions. The purpose of the study is to develop a methodological approach to building an intelligent decision support system combining multi-criteria optimization and simulation modeling to forecast the probability of an enterprise's crisis state.

The proposed system consists of three blocks: normalization of input financial indicators, multi-criteria aggregation of normalized scores into an integral crisis index, and Monte Carlo simulation generating a probabilistic forecast of this index under uncertainty. Four indicators were selected to characterize liquidity, financial autonomy, profitability, and asset turnover. Criteria weights were substantiated using the Analytic Hierarchy Process, with the consistency ratio confirming acceptable expert agreement.

To verify the model, a Monte Carlo simulation with 1000 iterations was performed on an illustrative example. The conditional enterprise falls into the increased-risk zone, with a 19.1 % probability of transitioning into crisis. Comparison with the classical Altman model confirmed the consistency of both approaches, while the simulation additionally quantifies the probability of crisis transition. A sensitivity analysis across alternative weighting scenarios confirmed the robustness of the model.

The scientific novelty lies in combining multi-criteria aggregation with stochastic

simulation to obtain a probabilistic, rather than point, estimate of crisis risk. The approach provides management with a probabilistic range of states and quantified transition probabilities. Practical recommendations are formalized for each of three risk zones. Automated updating of input indicators from accounting and reporting systems allows the model to function as a continuous early-warning tool rather than a one-off diagnostic exercise. Further research directions include empirical distributions, criteria correlations, and validation on real enterprise data.

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