**Stochastic optimization models for the orders formation of**

**trading companies**

Olga Sviridova,

Plekhanov Russian University of Economics

Academic Department of Mathematical Methods in Economics

**Problem statement.** Any business, including trade, is an area that requires constant improvement and development. For effective functioning and maintaining competitiveness in unstable market conditions, constant innovation and the search for new effective solutions are needed. This applies in particular to the organization of the supply chains of trade organizations, since inventory management plays one of the key roles in enterprise management.

Companies have a strong interest in inventory optimization, in other words in reducing inventory investment while maintaining or improving service levels. In the Western market, these trends can be traced clearly, as evidenced by analysts of the market for application software for supply chain management, as well as many works on optimization of stocks [1, 2, 3]. However, in Russia, in practice, management decisions on the organization of the flow of goods, with the exception of large companies, are made within the framework of pre-developed plans or with a focus on average demand indicators. Thus, the uncertainty of both demand and delivery times remain unaccounted for, which negatively affects the final financial result.

For many domestic companies, the question of what quantity of goods and when to order in order to achieve optimal performance indicators of the enterprise, taking into account technological, financial and resource constraints, as well as the variability of the parameters of the market environment, remains really relevant. At the same time, tools are needed to optimize inventory planning solutions taking into account such factors as the time value of money, the choice of vehicles and suppliers [4, 5].

**Models.** Models of optimization of the most important parameters of the inventory management strategy are considered: the moment of assignment of delivery and its volume, taking into account both the uncertainty of demand and the time of delivery (the corresponding factors are considered both independently and together). Another group of models is designed to determine both the volume and the moment of delivery in the presence of restrictions that reflect the conditions of a real enterprise in an unstable economic environment according to the criterion of maximum profit, taking into account the time value of money and the random nature of the demand. Stochastic simulation and optimization models make it possible to determine the optimal moments of deliveries and volumes of deliveries, as well as to make the optimal choice of the enterprise's counterparties (suppliers, transport companies, credit organizations).

**Methodology.** The considered economic and mathematical models are models of linear programming, nonlinear programming, simulation and optimization programming. For analytical studies in the models, there is an assumption about the normal distribution of demand and delivery time of the goods. The criterion functions of profit maximization and cost minimization are used.

**Results.** For the tasks under study, the author obtained analytical dependencies to determine the optimal values ​​of the volume or the moment of delivery. In this formulation, the problem of stock optimizing is set for the first time. The developed complex of economic and mathematical models of the inventory management system allows finding the parameters of optimal inventory management strategies based on optimization methods, imitation and their combination with various combinations of factors taken into account, including taking into account the time value of money. The iterative algorithm makes it possible to compute the optimal parameters of the inventory control strategy in the selected software environment.

The optimization approach with taking into account the uncertainty of demand and delivery time, the principle of the time value of money increases the efficiency of management decisions. The advantages of this approach are as follows: consignments of goods arrive at the most favorable moment, the range of products is optimized, the turnover of warehouse space is increased, relations with suppliers, transport companies, banks are optimized by reducing costs, it becomes possible to offer competitive prices.

 **References:**

1. Giacomo, L. D., Giacomo, P. (2010), Methodological analysis of supply chains management applications, European Journal of Operational Research, Vol. 207, Issue 1, pp. 249-257, ISSN 0377-2217, <https://doi.org/10.1016/j.ejor.2010.05.003>.

2. Giovanni, P. D. (2021) Smart Supply Chains with vendor managed inventory, coordination, and environmental performance, *European Journal of Operational Research*, Vol. 292, Issue 2, pp. 515-531, ISSN 0377-2217, <https://doi.org/10.1016/j.ejor.2020.10.049>.

3. Goh, M., Lim, J. Y.S., Meng, F., (2007), A stochastic model for risk management in global supply chain networks, *European Journal of Operational Research*, Vol. 182, Issue 1, pp. 164-173, ISSN 0377-2217, <https://doi.org/10.1016/j.ejor.2006.08.028>.

4. Kosorukov, O. Algorithm for determining the economic purchase size in the conditions of the demand volatility / O. Kosorukov, S. Maslov, O. Sviridova // Journal of Advanced Research in Dynamical and Control Systems. – 2020. – Vol. 12. – No 5 Special Issue. – P. 1129-1138. – DOI 10.5373/JARDCS/V12SP5/20201866.

5. Sviridova, O.A. Imitatsionnyye modeli v zadachakh upravleniya zapasami / O.A. Sviridova // Elektronnyy nauchnyy zhurnal «Izvestiya REU im. G.V. Plekhanova» - 2011. - №2 - S.127-135.