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# APPLICATION OF INFORMATION TECHNOLOGIES IN SOLVING ECONOMIC PROBLEMS

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There are many methods for solving economic problems in various spheres of human activity [5]. One of the most common methods is the *combination of mathematical* [2] *and simulation* [7] *modelling*: Modelling of the studied system, processes or observed environment. This methodology includes the use of information technology (IT). A brief overview of this methodology is presented in this paper.

The combination of mathematical and simulation modelling of the observed environment is shown in the example of the inventory management problem of perishable goods in grocery retail. Research is limited to one food retailer with many grocery stores (stores). The *inventory management problem* in a grocery store lies in the determination of the time period and optimal quantity of products in one order, i.e. when and how much should be ordered so as to incur the lowest expenses possible. We show an example of mathematical models to solve such an economic problem for perishable products in [3].

For simulation modelling it is necessary to use IT. With the help of IT, for example, we can simulate the operative daily work of a food retailer. The main advantage of using the simulation is to help to understand the influence of the chosen mathematical model on logistics in grocery stores of the retailer. Simulation of the replenishment processes in the stores allows us also to carry out the proposed mathematical models without their direct use in the grocery stores.

Figure 1 presents the method of mathematical and simulation modelling for solving the above mentioned economic problem. The steps suggested in the model are explained further.

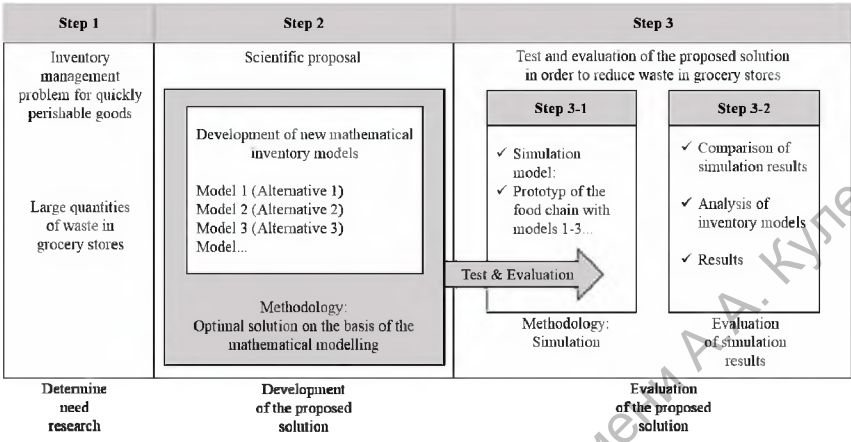


**Figure 1. Method of solving the inventory management problem in grocery retail**

**Step 1** (in fig. 1): Here we examine the need to study the inventory management problem for a grocery retailer. The reason for the research is the large amount of waste in grocery stores. For example, about 550,000-750,000 tons per year of perishable goods are discarded in Germany's retail [6]. Germany has aimed to reduce the amount of waste by 50% by 2030 [1].

**Step 2:** This step shows several developed mathematical models for the inventory management problem of perishable goods. An example of one of these models (simplified) is published in [4].

**Step 3: Step 3-1** contains the prototype of a grocery retailer with 30 to 70 stores to test the above described mathematical models. A comparison of simulation results of experiments using these mathematical models is shown in **step 3-2**. For the final conclusions (adequacy or inadequacy) of the mathematical models, it is also necessary to compare the results of experiments with the *typical* mathematical models to understand how they affect daily work in grocery stores (their influence on logistics). Also, the analysis of the developed models is made with various parameter values. At the same time, we consider such important economic indicators in grocery stores such as cash expenses for inventory holding costs, fixed order costs, delivery costs etc. Additionally, in this step we analyze waste quantity and costs of discarded goods with an expired lifetime. Finally, in step 3, we have a complete review and assessment of the scientific proposal developed in step 2.

The reliability of the conclusions which are reached in step 3, depends on the quantity and quality of the experiments, but also on the data on which they

are based. The more realistic the modelling and values of the parameters are (for example, expected demand, inventory cost per item, etc.), the more significant the research conclusions of the experiments are.

Practical use [4] of the described method shows that the combination of mathematical [2] and simulation [7] modelling is convenient to use because it clearly separates the steps into the mathematical and the simulation part. Without IT, it would be impossible to simulate the system and quickly find the best solution to the mathematical ordering problem. Therefore, IT plays a significant role in this method and in the solving of many economic problems.

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