

Lecture 3.

**Methods of analysis in logistics systems.
Methods used in logistics systems, basic models and
types of modeling processes in a logistics system.**

Discipline: Pharmaceutical logistics 5 course, 9 semester

Lecture questions:

1. Analysis of logistics systems: purpose, tasks, necessity of implementation.
2. Stages of analysis of logistics systems.
3. System, economic, financial analysis, analysis of full cost in the study of logistics systems.
4. General characteristics of methods of studying logistics systems.
5. Graphical method in logistics research: disadvantages, advantages.
6. Modeling of processes in the logistics system: isomorphic and homomorphic models.
7. Material and abstract models in logistics.
8. Mathematical modeling: types, stages, disadvantages, advantages.

- ▶ **Analysis of logistics systems is a procedure for research, development, justification and decision-making in the process of designing or reengineering (redesigning) the logistics system of an enterprise.**

- ▶ **The main thing in the analysis of logistics systems is to turn the complex into the simple or to turn a difficult to understand logistics problem into a set of tasks that have a solution, as well as to search for effective means of research and management of material flows.**

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- ▶ **The need for analysis of logistics systems arises:**
- ▶ **when solving global, general and local logistics problems at the level of groups of enterprises, the enterprise as a whole and in the functional areas of logistics; designing and forming logistics systems when creating an enterprise; when modernizing the material flow management system at an enterprise; developing a strategic plan in the field of enterprise logistics for the long term.**

- ▶ **The purpose of the analysis of logistics systems is to identify existing shortcomings or “bottlenecks” in the interaction between individual participants in the process of physical movement of goods at the macro and micro levels.**

- ▶ **To achieve the set goal, the following main tasks are solved: to develop a program for the development of the enterprise's logistics system; to check the efficiency of interaction between links and elements of the system, to identify "bottlenecks" and eliminate them; to identify the efficiency of the enterprise management organization, the functions and structure of management bodies; to determine specific indicators of the functioning of the enterprise's logistics system.**

- ▶ **Thus, the analysis of logistics systems ensures the identification of problems and the selection of directions for changing the current situation at the enterprise and in the supply chain.**
- ▶ **In general, the algorithm for improving the operation of a logistics system is as follows: the logistics system is divided into subsystems, links and elements in order to identify tasks that are more accessible for solution (analysis); the most suitable special methods are selected and applied to solve individual problems; individual solutions are combined in such a way as to ensure the achievement of the global goal of the enterprise or supply chain (synthesis).**

Logistic analysis is performed in stages:

- ▶ **Stage 1. Collecting data on the logistics system. It is necessary to study the structure of the physical model of the enterprise and the stable paths of movement of material flows, the composition of logistics functions and operations. Stage 2. Correct and clear description of the logistics system. This action can be performed both by the enterprise employees and by involved specialists as part of a logistics audit.**

- ▶ **Stage 3. Establishing the relationship between the goals of the logistics system and the means of achieving them.**
- ▶ **Stage 4. Developing and evaluating several options for developing the logistics system, taking into account the expected management impacts based on the results of the analysis.**

- ▶ **Stage 5. Selecting the optimal option for developing the logistics system.**
- ▶ **Stage 6. Developing a detailed program for improving the logistics system based on the selected option.**

- ▶ **Depending on the level of structuring, three classes of logistics systems are distinguished: well-structured or quantitatively formulated; unstructured or qualitatively expressed; weakly structured or mixed, containing qualitative and quantitative indicators.**

- ▶ **After changes in the enterprise's logistics system, an economic and financial analysis is carried out.**
- ▶ **This allows us to evaluate the management decisions taken, which are reflected in the level of total costs, profits, profitability and other resulting indicators.**

- ▶ **Full cost analysis.**
- ▶ **This method is used to make decisions related to transportation, warehousing, and other logistics functions.**
- ▶ **For example, choosing an in-house warehouse or a shared warehouse; choosing one centralized warehouse or several decentralized distribution centers; choosing a transportation option.**

Logistics methods:

- ▶ **The main methods used to solve scientific and practical problems in the field of logistics include:**
- ▶ **system analysis methods;**
- ▶ **operations research methods;**
- ▶ **forecasting.**

- ▶ **Research into logistics systems includes:**
- ▶ **study of approaches to managing logistics systems, which include economic, social, and communication processes at the macro and micro levels;**
- ▶ **systematic collection of information on material flows.**

- ▶ **Analysis of the obtained information about the links and elements of the logistics system allows for the application of well-founded management decisions at the enterprise.**
- ▶ **Analysis methods facilitate the work of logisticians when studying large arrays of information (for example, when managing inventories).**
- ▶ **As part of improving logistics systems, close attention is paid to optimization tasks that are used in various areas of the enterprise's activity.**

Economic and mathematical methods

- ▶ When optimizing the movement of material flows, economic and mathematical methods and modeling are used. This set of tools can be implemented in software products used to solve optimization problems in logistics. Optimization methods are used to solve the following logistics problems: placement of a warehouse network in wholesale trade; drawing up routes for the movement of vehicles; placement of goods in a warehouse.

Graphical method

- ▶ The graphical method is widely used in the analysis of logistics systems. It is used to describe the configuration of material flows, identify the general structure and functions of the logistics system, and determine ways to improve it.
- ▶ A graphical diagram of the movement of material flows allows you to trace the paths of their movement, identify the places of origin, transformation and absorption, and also determine the logistics operations that are carried out with them.

Advantages of the graphical method

- ▶ As a result of analyzing the graphical flow chart, it is possible to establish the volume, nature and timing of work for each element of the logistics system, the presence of control over the execution of work or its complete absence, to identify the reasons for excessively long storage of products and unjustified delays in sending them to the consumer.
- ▶ The simplicity, versatility, clarity and economy of the graphical method contribute to its popularity and frequency of practical use.

Disadvantages of the graphical method:

- ✓ with an increase in the number of links in the logistics system, the graphical diagram can be so large that it loses its value as a means of studying and analyzing material flows;
- ✓ the preparation of graphical diagrams of material flows is characterized by significant labor intensity, which, given the dynamic nature of logistics processes, affects the timing of the study and the reliability of its results;
- ✓ graphical diagrams do not allow for a qualitative and quantitative assessment of the effectiveness of the measures used to optimize the movement of material and related flows.

Graph theory and network models

- ▶ When studying logistics systems at the macro and micro levels, the method of graph theory is also used (allows you to reproduce and analyze the structure of an economic process or phenomenon, a graph consists of many points and many segments connecting some of them) and network models (allow you to represent and analyze problems in the form of networks that will help answer two main questions: what place should you reach (goal) and what path should you choose). These methods provide visibility of the movement of flows, it becomes possible to track the dynamics of material flows, rationalize business connections, and draw up a schedule for the delivery of goods to consumers.

Modeling of processes in the logistics system

- ▶ Modeling is based on the similarity of the model to real systems or processes, which can be complete or partial. The main goal of modeling is to predict the development of a process or the behavior of a system. An essential characteristic of any model is the degree of completeness of the similarity of the model to the modeled object. According to this feature, all models can be divided into isomorphic and homomorphic.

- ▶ **Isomorphic models.** They include the characteristics of the original object and are capable of essentially replacing it. If an isomorphic model can be created and observed, then our knowledge of the real object will be accurate.
- ▶ **Homomorphic models.** They are based on an incomplete or partial similarity of the model to the object being studied. In this case, some parts or functions of the real object are not modeled at all. As a result, the construction of the model and the interpretation of the research results are simplified. Homomorphic models are more often used in logistics.

In logistics research, material and abstract models are created

- ▶ **Material models** reproduce the main geometric, physical, dynamic and functional characteristics of the phenomenon or object being studied. For example, reduced models of wholesale trade enterprises, allowing to solve problems of optimal placement of equipment and organization of material flows. Material models can be isomorphic and homomorphic.
- ▶ **Abstract modeling** is often the only way of modeling in logistics research. It is divided into symbolic and mathematical. Symbolic models include language and sign models.

Symbolic models

- ▶ **Language models are verbal models based on a set of words (dictionary) cleared of ambiguity.**
- ▶ **Sign models.** If we introduce a conventional designation of objects, i.e. signs, and also agree on the types of connections between these signs, then we can give a symbolic description of the logistics system. Sign models can be used in the graphical method.

In logistics, two types of mathematical modeling are used:
analytical and simulation.

- ▶ **Analytical modeling** is a mathematical technique for studying logistics systems that allows obtaining accurate solutions to logistics problems.

Stages of analytical modeling:

- ▶ **Stage 1.** Mathematical laws are formulated that link the parts of the system. These laws are written in the form of equations (algebraic, differential, etc.).
- ▶ **Stage 2.** Solving the equations and obtaining theoretical results.
- ▶ **Stage 3.** Comparison of the obtained theoretical results with practice (checking for adequacy).
- ▶ **As logistics systems become more complex, research using analytical methods is difficult.**
- ▶ **The advantages of analytical modeling include greater generalization power and multiple use.**

Simulation modeling

- ▶ **Simulation modeling includes two main processes: the first is constructing a model of a real system; the second is setting up experiments on this model.**
- ▶ **The main advantage of simulation modeling is that this method can solve complex problems, since random effects that create difficulties in analytical modeling are taken into account quite simply.**

Simulation modeling

- ▶ **Disadvantage 1.** Research using this method is expensive because: a highly qualified programmer is needed to build a model and experiment on it; a large amount of computer time is required because the method is based on statistical tests and requires multiple runs of the program; models are developed for specific conditions and, as a rule, are not replicated.
- ▶ **Disadvantage 2.** The likelihood of false imitation. Processes in logistics systems are probabilistic in nature and can be modeled only by introducing certain types of assumptions.

- ▶ *Logistics research combines material and abstract models.*
- ▶ *Methods in logistics should be used comprehensively, which makes it possible to eliminate the limitations of each method separately.*

THANK YOU FOR YOUR ATTENTION!