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«ЛОГИСТИКА:
СОВРЕМЕННЫЕ ТЕНДЕНЦИИ РАЗВИТИЯ»

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Сборник материалов конференции посвящен вопросам логистики. Рассматриваются теоретические аспекты логистики, вопросы практического применения логистических принципов, преподавания логистики в высших учебных заведениях. Издание предназначено для преподавателей вузов, для специалистов, чья деятельность связана с логистикой, и для всех интересующихся этой проблематикой.
ANALYSIS AND SYNTHESIS OF THE DESIGNED LOGISTICS SYSTEMS

The structure of the applied theory of the logistics systems design and planning continues to evolve in the circumstances of supply chain integration. The synchronization of material, service, information, and intellectual flows offers new opportunities for cross-disciplinary analysis. The article considers the development of conceptual framework, as well tactical and operational levels (e.g. existing terms and definitions, economic indicators, methods and models) that are applied in the research on the creation of value nets in terms of their flexibility, speed and reliability.

Keywords: value nets, conceptual framework, methods and models, integration, reliability

Specifics and intensity of supply chain integration lead to multiple relations between the companies involved in the processing of goods. The nature of integration in the supply chain is becoming more diverse and multidimensional, which prevents the sequential organisation of the supply chain in the form of the pipeline [1]. Therefore, according to Bovet and Martha (2000), nowadays topical issues concern design and planning of logistics systems, which should be conceptualised as value nets, rather than the supply chains with a linear structure [2]. In order to ensure such approach, taking into account customer-centric, collaborative, agile, scalable principles of value nets development, the use of information technology is inevitable. Digital technologies help to automate transactions capabilities and the integration of the processes required for the adoption of joint management decisions [3].

Under these circumstances, the conceptual apparatus of the integrated supply chain planning continues to evolve. Additionally, the methods and models related to the management of all business processes in the key functional areas of logistics: procurement, production, distribution are under improvement [4, 5, 6]. Critical shifts take place in the conceptual framework of the design of multi-level supply chains based on personalization of their participants and synchronization of different flows (Figure 1) [7].
For the designing of the supply chain, it is essential to take into account the particular systems with a combined structure. Their specific cases may correspond to the simplest systems (a-c, c-d, etc.) or the systems with two- and three-level structure (a-c-d, b-c-d, etc.) or more complicated structure typical to the production and distribution systems (c-d/e, a-c-d/e, etc., Figure 1) [4]. It is also important to take into consideration the personification of all the participants of the simple logistic chains, e.g. suppliers, customers, and intermediaries, which assume outsourcing. In this regard, there is a need in the distribution of costs and their representation in regard to the added value in the price of the product [8]. These ideas, which can be seen as the basis for the integration of material and financial flows, have been developed in research of V.V. Lukinskiy, G.L. Brodetskiy. Further on, the modification of methods and models applicable for the synchronisation of the material, finance, information flows was reflected in scientific works of S.E. Barykin, S.A. Karpunin. The transformation of methodology related to the managements of human resources and other flows have been studied by E.V. Budrina, V.S. Lulinskiy, E.R. Schislyaeva [9]. In recent scientific studies of E. V. Budrin, O.M. Syardova, service flows, which are integrated with the above-mentioned flows are considered as the object of study in terms of models and methods of logistics and supply chain management.

For effective planning and controlling of material flows and related flows, the following metrics, which are categorised in five performance attributes, are recommended for the use [10]:

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Perfect order regarding «7R»</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Replenishment cycle</td>
</tr>
<tr>
<td>Agility</td>
<td>The dynamics of order fulfilment, the levels of adaptability and flexibility of the supply chain, the assessment of risk in the supply chain</td>
</tr>
</tbody>
</table>
The scientific basis for the management of material, information, finance, service and personnel flows encapsulates the models and methods of the theory of logistics:

- **Transport models** (assignment problem, transportation model with intermediate points, etc.)
- **Network models** (search for the shortest path problem, maximum flow problem, network planning methods, the problem of finding the minimum cost flow, etc.);
- **Deterministic and probabilistic models of dynamic programming** (recursive forward–backward algorithm, the investment problem, maximizing the probability of achieving the goal, etc.);
- **Deterministic and stochastic inventory management models** (static model, dynamic problems of the economic order quantity, the model with continuous stock level control, combined models, etc.);
- **Markov decision processes** (dynamic programming model with a finite number of steps, a model with an infinite number of steps, etc.);
- **Queuing system** (model of birth and death, a general model of queuing systems, specialized systems, etc.);
- **Game theory and decision-making**, respectively, in conditions of certainty, risk, uncertainty, etc.;
- **Simulation modeling** (Monte-Carlo method, discrete simulation, random number generation, simulation of random processes, etc.);
- **Systems dynamics** (limit behavior of the average number of states, equation of mixed type, tasks like "predator-prey", etc.);
- **Forecasting methods** (simple and exponential smoothing, trend multifactor models with allowance for seasonality, synthesis of forecasts, etc.).

In conclusion, it should be noted that the combination of these models and methods for describing the systems and conducting numerical experiments contribute to the accuracy and reliability of the results, which can be obtained more effectively in the case of using computer simulation.

**References**

Variety of inventory management models known in logistics theory. Design of models for inventory management in a multi-level inventory placement systems are popular field of studies nowadays. One such model is Sven Aksater’s model. Like most models, it is applicable in cases where all the main parameters – demand per day, delivery time, the volume of orders, delay in logistic cycles and etc. – are deterministic. Obviously, in practice these parameters are random variables. The article presents two models for the economic order quantity calculation for two-leveled supply placements system, taking into account safety stocks and deficit at different levels, depending on the inventory management strategy – with fixed order amount or fixed time interval between adjacent orders.

Keywords: logistics, supply chain management, inventory management, supply chain, logistic system, multi-leveled system