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TO THE QUESTION OF THE ASSESSMENT OF THE EFFECTIVENESS OF THE SUPPLY CHAIN

Abstract
The article explores the history and usage of the common expression ‘logistical chain’. The semantics suggests that the phrase is still under development and consensus has yet to be reached. Along with the term, the other phrases, such as ‘logistics system’ and ‘supply chain’ have been developed as synonyms. Meanwhile, the differentiation of these terms is considered as an inevitable task in the case of the realisation of an independent supply chain management paradigm. In this regard, for the assessment of the efficiency of the logistics chain, the model of flow (or modules) management and an integrated vector criterion is proposed.

Keywords: assessment of the effectiveness, supply chain, logistics system, integrated vector criterion.

Nowadays, the concept of ‘logistics chain’ is widely used in the theory and practice of logistics. To study the semantic content of the term the author performed a literature review (Bowersox and Closs, 2008; Christopher, 2004; Malikov, 2003, 2014; Sergeev, 2009), which showed that the current consensus concerning the semantic content of the concept of ‘logistical chain’ does not exist; term semantic content is constantly refined and adjusted. Based on a synthesis of the views of the majority of foreign and domestic scientists and experts in the field of logistics, the generalized definition of the term can be expressed as follows: ‘the logistical chain is a set of organizations or persons directly involved in the external and internal flows of products, services, finances and/or information from the source of origin to the consumer’ (Christopher, 2004; Romanov and Kizlyak, 2004). Undoubtedly, there are other interpretations of the term ‘logistical chain’. In overseas literature, along with the concept of ‘logistical chain’, the words ‘logistics system’ and ‘supply chain’ are widely used. Moreover, these terms are often applied interchangeably. However, when it is required to consider independent supply chain management paradigm, the differentiation of these terms seems important and urgent task.

The term ‘logistics system’ is commonly understood as an ordered structure, in which the planning and realisation of the traffic are organised in the form of logistics flow, starting from the extraction of environmental resources up to the realisation of the final product. ‘Supply chain’ is defined as the integration of all types of business processes (e.g., design, production, sales, service, purchasing, distribution, management, and support functions) that are
required for the confirmation of the demand for products and services from the initial point of origin of the raw material or the information to the final delivery to the end consumer. ‘Logistical chain’ is a linearly ordered set of individuals and/or entities, i.e. suppliers, logistics intermediaries, who are directly involved in delivering to a particular recipient (customer) necessary materials and/or finished products (Bowersox and Closs, 2008; Christopher, 2004; Malikov, 2003, 2014; Sergeev, 2009).

However, the emphasis in the interpretation of the term ‘logistical chain’ is advisable to shift toward the expanded definition of supply chain management (SCM), which is provided in the standards of logistics and supply chain management. Indeed, in the supply chains, the organisation, planning, control, arranging, and forwarding of goods flow is carried out. It means that in addition to the functions mentioned above, in supply chains, administrating, coordinating, and supporting activities are also provided.

Based on the foregoing, one can conclude that the ‘logistical chain’ is an aggregate of organisations (companies, manufacturers, warehouses, distributors, freight forwarders, etc.) that interact with the material, financial, and information flows, as well as the flows of services, originating from raw material and directing to final consumer of finished products. In fact, in the supply chains, the flows and related coordinating processes are realised.

In the general theory of the logistics, the flow is referred to the totality of objects, perceived as a whole that exists as a process at a certain time interval and can be measured in absolute terms for a specified period (Christopher, 2004; Malikov, 2003; Sergeev, 2009). For example, material (goods) flow is defined as the volume of traffic, processed per unit time through the cross section of the path in a direction of transportation. For the effective forwarding of material flows, the circulation of financial and information flows is needed.

On the whole, the supply chain as logistics system is represented in the form of a model for flow (or modules) management, where consumers can be represented by the consumers of finished products, as well as businesses that need the materials, raw materials, and services. The implementation of such a ‘modular’ approach certainly allows applying universal methods of logistics, which include the methods of flow management for production and transport systems of any complexity and structure.

On the other hand, the main control parameters of the logistics chain as a system are: product (desired product); quality (the required quality of the product); amount (the required quantity); time (product delivery to the target date or a specific time); place (delivery of the product to the right place); consumer (for a particular user); costs (minimum costs; Bowersox and Closs, 2008; Malikov, 2014; Sergeev, 2009).

Indeed, the practice of conducting business in Russia and abroad shows that the efficiency and competitiveness of enterprises are mostly determined by the achieved level of the organisation of forwarding flows of goods. The level of
its organisation, in turn, determines the magnitude of benefit in the supply chain, resulting in the appearance of aspects of added value along with the expenses kept a given level. In other words, the design of highly efficient logistical chains should be among the priorities of the enterprises. However, how to evaluate their effectiveness?

It seems that the evaluation of the effectiveness of logistical chains is advisable to carry out by the application of a complex vector criterion, using the methodological approach proposed by Romanov and Kizlyak (2004):

\[ K(x_i) = \{k_1(x_i), k_2(x_i), \ldots, k_m(x_i)\} = \{k_j(x_i); j = 1, M\}, \tag{1} \]

where \( k_j(x_i) \) – j partial criterion; \( M \) – the number of individual criteria.

With this approach, the criterion function \( K(x_i) \), which takes into account a variety of options, generates an order relation, depending on the semantic content of the function. For example, if from \( K(x_i) > K(x_S) \) follows that \( x_i > x_S \) it makes sense to the criterion is the ‘effect’. In the supply chain, such criteria may be the speed of forwarding goods \( (V_{np}) \), a number of transport units involved \( (n) \), etc. If, on the contrary, \( x_S < x_i \), than \( K(x_i) \) is a criterion of ‘cost’ type, which implies the cost of downtime waiting for transportation, \( (t_w) \), logistics cost \( (l_c) \), etc.

Then, the mathematical formulation of the vector optimisation problem can be expressed as follows:

\[
\begin{align*}
X^*_j &= x_j \\
\text{max } k_j(x_i), & j = 1, M \\
\text{min } k_j(x_i), & j = m + 1, M \\
x_i &\in X
\end{align*} \tag{2}
\]

Each of the equations (2) causes a variant of the solution, the use of which is only preferable from the viewpoint of the one criterion. Meanwhile, the general solution can be represented by the intersection of the sets of solutions’ results for each particular criterion:

\[ X^* = X^*_1 \cap X^*_2 \cap \ldots \cap X^*_M \tag{3} \]

By assuming as an objective function the minimum mismatch between the given and actual values for each criterion and criterion field as a whole, it is possible to solve problems of assessing the effectiveness of individual supply chains and optimisation of logistics and traffic of goods.
References


