



DETERMINATION OF A RATIONAL STRUCTURE OF THE SECURITY SERVICE INTEGRATED LOGISTICAL SUPPORT SYSTEM BASED ON REGIONAL LOGISTICS CLUSTERS

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ABSTRACT

Development of an integrated logistical support system for all types of national security services requires the solution to a problem of definition its rational structure. The methodical approach proposes to consider this issue as a complex of two successive optimization tasks. In the first place, it assumes to determine regional logistics clusters amount and then to optimize their logistics infrastructure. The models and methods are developed to allow optimization of the integrated logistical support system structure according to a real transport network communications and a regional supply chain by a minimal total logistics costs criterion.

KEY WORDS

rational structure, the Security Service integrated logistical support system, regional logistics clusters, total logistics costs, optimization

LANGUAGE OF THE PAPER

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STANOVENÍ RACIONÁLNÍ STRUKTURY BEZPEČNOSTNÍ SLUŽBY INTEGROVANÉHO LOGISTICKÉHO PODPORNÉHO SYSTÉMU ZALOŽENÉHO NA REGIONÁLNÍCH LOGISTICKÝCH KLASTRECH

Abstrakt: Rozvoj integrovaného podporného logistického systému pro všechny typy národních bezpečnostních služeb vyžaduje řešení problému definice jeho racionální struktury. Metodický přístup navrhuje zvážit tuto otázku jako komplex dvou po sobě následujících optimalizačních úloh. V první řadě se předpokládá určit počet regionálních logistických klastrů a pak optimalizovat jejich logistickou infrastrukturu. Modely a metody jsou vyvinuty tak, aby umožňovaly optimalizaci struktury integrovaného logistického podporného systému podle reálné dopravní sítě komunikací a regionálního dodavatelského řetězce kritériem minimálních celkových logistických nákladů.

Klíčová slova: racionální struktura, bezpečnostní služba integrovaného podporného logistického systému, regionální logistické klastry, celkové náklady na logistiku, optimalizace

Introduction

The objective necessity of the cooperative applying of various security services' organizational formations under current conditions, the monotony of the majority of logistical support they used and economical integration advantages are induce incorporation of logistical support departmental systems for various security services into a unified integrated system [1]. Whereas the present system is complex economic and geographically distributed, the structurization task arises by a territorial principle [2].

In conditions of reduction of the security services' costs level in transitional economy countries, rational structure developing of the integrated logistical support system is relevant and provides cost of maintaining economy. According to a logistic nature of the supplying processes, it is appropriate to structurize integrated system based on the regional logistics clusters. It enables to organize security services' organizational formations effective logistical support through minimization of reserve stocks maintenance costs in a multilevel storage system and logistical stocks delivery.



1. The methodical approach

Structure of the integrated logistical support system includes two components: organization management structure and logistics infrastructure. The first represents composition of system management items, their communications and subordination. The second is considered as a set of elements used for logistics processes implementation and facilitated to a logistic tasks solution [3].

The integrated system structurization based on cluster methodology assumes regional logistics clusters formation, as basic structural composition of system logistics infrastructure. In modern science, the regional logistics clusters are considered as a region localized group of companies and organizations. Such companies co-operate or compete with each other, provide all types of logistics services bound up with the goods movement and processing in order to achieve particular economic effect and implement the area competitive advantages [4, 5].

In contrast to business environment, the regional logistics clusters of the integrated logistical support system are geographically localized non-profit association of their logistics infrastructure objects. The key elements of these territorial formations are:

- the regional logistics centers implemented the logistics functions (procurement and supply organization, resources distribution) and at the same time the regional management agency functions of the integrated logistical support system (planning, organization, control and regulation of the organizational formations logistics processes located in the region);
- the regional transport and storage complexes by type of collateral that implement the functions of bulk buying, extra goods storage, cargo processing, logistical resources distribution and delivery to the storages of the security services' organizational formations located in allotted regions.

Starting from this, it is proposed to divide the task of determining of a rational structure of the security service integrated logistical support system into two successive optimization tasks. Firstly, it assume to determine rational regional logistics clusters amount and then to optimize their logistics infrastructure.

2. Determination of the optimal regional logistics clusters amount

The task of determination of the rational regional logistics clusters amount is an optimization task of structurization. The mathematical model of determination of the rational



regional logistics clusters amount is proposed in order to solve aforementioned task and formed by the minimum total logistics costs criterion. Generally, the total logistics costs include:

- total regional warehouse maintenance costs;
- total store keeping costs at the regional warehouses;
- total transportation costs for resources delivery from central warehouses to each cluster's regional warehouses;
- total transportation costs for resources delivery from regional warehouses to organizational formations' warehouses located in the same cluster.

Considering nomenclature sameness of the majority of resources consumed by various security services' organizational formations, only logistics providing types are highlighted in this model. A warehouse type is determined by the logistics providing type. Storage costs are differentiated by the warehouse type and size (area). Transport rates and costs – by distance and vehicle's load capacity. Logistics freightage is implemented under the scheme: central warehouse – regional warehouse – organizational formation warehouse. Cargo delivery is implemented from the central warehouses by rail and from the regional warehouses by road.

The initial data for this task solution are:

- location of the security services' organizational formations;
- organizational formations' needs for logistical resources;
- warehouses area;
- maintenance costs for warehouse of each type;
- store keeping costs at the warehouse of each type;
- vehicle's load capacity;
- railway or roadway freightage rates;
- transport costs for the freightage by own trucks.

The clustering iterative method is proposed. At first, the initial amount of clusters is set (it may correspond to the administrative-territorial segmentation of the country). The method consists in successive clusters enlargement through their incorporating according to the rule: the contiguous clusters combine if they have the shortest distance between their "centers". Cluster "center" – the location of the organizational formation in each cluster least removed from the locations of other organizational formations in the same cluster. Search of the cluster "center" is implemented using the Bellman-Shimbel Distance Matrix (D-Matrix) method [6]. The regional warehouses for all types of providing locate in the detected cluster "center". After each iteration, the total logistics costs are



calculated and represent the storage costs and logistical resources delivery for the determinate clusters amount.

Current cyclic process of the small clusters combining into the larger clusters has executed until an option with the lowest total logistics costs isn't be obtained or their variation becomes insignificant. In the second case, final decision is made by the experts and count additional factors affected to the selection of the regional logistics clusters amount (transport infrastructure, security services organization, their tasks priority, etc.).

3. Logistics infrastructure optimization

After determination of the regional logistics clusters' rational amount it is necessary to optimize its infrastructure considering possible material flows between logistical resources suppliers and consumers located in each cluster. It is essential to take into consideration the presence or absence of different types of the logistics warehouses in the clusters allocated territory and the capacity which allows using them as regional storehouses. According to this, two opposite tasks arise: selection from the several required amount warehouses for a particular region or determining new warehouses' amount and location in the region where they are lacking. Both of them are transport optimization tasks and assume to obtain the solutions by the minimum of total logistics costs criterion.

The initial data for these tasks solution are:

- amount and location of the specific logistical resources suppliers;
- amount and location of the security services' organizational formations;
- logistical resources nomenclature;
- suppliers' production and marketing capabilities;
- needs of the organizational formations;
- warehouses capacity;
- vehicle's load capacity;
- maintenance costs for warehouse of each type;
- store keeping costs at the warehouse of each type;
- freightage rates by hired trucks;
- transport costs for the freightage by own trucks;
- reserve stock level for each item at logistical resources nomenclature stored in warehouse;



- suppliers and consumers' importance coefficients representing their functioning features, their significance and other factors.

Due to the above, the task of warehouse selection, in superfluity case, is to define the suppliers and customers fixing rational plan through the available warehouses in the particular cluster. Our assumption for the task solution is the formal heuristic method which allows getting optimal regional warehouses amount through several iterations of the transportation problem providing minimum total logistics costs.

The second task looks toward the new storage chain formation of the regional logistics cluster, therefore it must consider present transport communications of the region and storage capacity needs. In addressing this task, the proposed method allows determining the warehouses' optimal number and locations into the cluster by the criterion of the minimum total logistics delivery costs from suppliers through warehouses and as a result to the security services' organizational formations. This would suggest that optimal delivery and storage routes of predetermined insurance supplies level which shall be contained on the cluster's regional warehouses will be necessarily considered.

Conclusion

The task of determination of the rational structure of the integrated logistical support system for security services consists of two interconnected optimization tasks. In the first case, the system is structurized into rational amount of the regional logistics clusters. Thereupon, their logistics infrastructure is optimized. This paper proposed the methodical approach to the consistent solution to the aforecited tasks providing global structure optimization.

The developed mathematical models and methods can adequately represent the composition and process functioning of the security services' integrated logistical support system. Furthermore, they allow complex solving its rational framework definition task through regional logistics clusters' distinctions and forming within them the optimal logistics infrastructure. It must be able to provide effective logistics of the organizational formations dislocated in different regions of the country considering current transport communications and storage regional infrastructure.

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